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ADVANTAGES OF CONSOLIDATION IN ELECTRICAL SYSTEMS.

The system of the Pacific Power & Light Company, described elsewhere in our columns, furnishes a striking example of a type of consolidation very valuable to the community. The company in question started by assuming ownership of a considerable group of electric railway, water and gas plants in the States of Oregon and Washington. This action of itself is very commonplace. The steps which have followed are ones that make for efficiency in the unification of service, the establishment of transmission networks and the building up of rural load. As our readers know, there is a wide territory in southeastern Washington which depends on irrigation for fertility. It is one of the finest fruit-producing sections of the country when irrigation is supplied, and not the least of the functions of the networks here considered is the supply of water by local pumping for irrigation purposes. The available natural water supply is here insufficient, but water can readily be pumped from wells and locally distributed through pipes with a high degree of economy. Motors having a total rating of 4000 hp, employed exclusively for this purpose, furnish no mean load. And no small part of the 4000 hp referred to as utilized for this purpose is in units of about 10 hp arranged so that the farmer may irrigate his land when and as much as he pleases. The work is done by small three-phase motors and centrifugal pumps.

The high-voltage network is of very simple construction carried mostly on 60-ft. poles and worked at 66,000 volts. There are now nearly 350 miles of line operated at this voltage, with about 125 miles of 22,500-volt lines in addition, and much rural distribution at 6600 volts, making in all between 500 and 600 miles of high-tension line linked into one system. The generating plants, partly steam and partly water, are for the most part of moderate size, but all pull together to the great betterment of continuity of service. One of the most encouraging features of electrical energy transmission has been the ease with which a group of plants can be operated in multiple on a large network. When tried at first it was with some fear and trembling, but in point of fact the few difficulties are easily overcome and the results are uniformly excellent. Plans are now being made for considerable enlargement of the energy supply system, including a connection for a high-voltage line with the system of the Washington Water Power Company, which has heretofore been described in these columns. The supply of energy to scattered rural communities, such as furnish a considerable portion of the load in the case before us, is an immensely useful work and can be carried on economically only by taking advantage of the consolidation of isolated plants into networks like this. The mere consolidation of holdings is a small matter, but physical consolidation, when carried out, brings material gain to all parties interested, to the consumer as well as to the owner.

HEATING LOADS FOR ELECTRICAL STATIONS.

The remarks of President George H. Harries of the Association of Edison Illuminating Companies on heat-storage devices in their bearing on station load may well serve as a text for a disquisition on missed opportunities. Very few central stations, and those only within a comparatively short time, have seriously taken up the problem of acquiring a domestic load. They have been so busy obtaining occasional big business that this small business, aggregating much load and relatively much more profit than large consumers, has been allowed to go by default into the ever-ready clutches of the gas companies. The consequence is that the general public, on which central stations have to depend for the revenues that keep them alive, barely knows that there is any such thing as electrical heating and cooking. The gas range, the gas hot-water heater, even the abominable gas radiator, are familiar from one end of the country to the other, while the corresponding electrical devices are looked on as fads for the rich, principally important as a source of amusement.

A note in the *Digest* by Mr. A. Rittershausen calls to the attention of the central station the gain which can be made by using heating appliances which involve the principle of heat storage, so that they will become off-peak load and can be more economically handled by both the station and the consumer. The storage idea is already carried out in some cooking apparatus in use in this country, but has not been employed enough to enter into station economics. In fact, the whole heating business, on account of the high prices usually made for energy for this purpose, has been rather a joke. We are glad to be able to report, however, that within the past few months a good many central stations have taken up the heating and cooking propositions seriously, and if the heat-storage principle can be brought to bear on the situation electrical heating ought to become, at prices which are now beginning to be quoted, a valuable addition to the load.

Ordinary cooking apparatus furnishes mostly off-the-peak load, its effect as a whole being rather to prolong the lighting peak than materially to increase it. The storage of heat either at low temperatures, as in hot water, or at high temperatures, as in heated metal, enables the bulk of the domestic load to be carried entirely off the peak. It consequently could be profitably furnished at a still lower price, bringing in turn a larger consumption. The critical point is to provide suitable thermal insulation, and toward this end the energies of manufacturers ought to be exerted. Storage at low temperature, as in water near the boiling point, is comparatively easy. Water has no superior as a heat reservoir within its temperature range, and a 50-gal. vacuum-jacketed tank, a sort of gigantic thermos bottle, can furnish comparatively cheap and wonderfully thorough heat insulation. Electrical heating lends itself with great facility to operating an apparatus of this kind, which can be automatically held at the desired temperature with a very small expenditure of energy and could easily be arranged for use entirely off the peak. High-temperature heat storage, of equally great importance, is a more difficult matter, less because the high-temperature body is hard to insulate than because one must be able to get at it for working purposes. All cooking apparatus thus far devised by human ingenuity is wonderfully crude, with the exception of a few recent devices, most of them small.

The physical difficulties to be overcome are considerable. the psychological ones very much greater. When the patient and painstaking householder is able to convince his or her cook that the full power of a gas range is not needed to keep the tea kettle simmering, electrical heating and cooking will become much more economical than at present. But even with the present handicap it will pay central stations to make a study of the available apparatus and its suitable use, with a view to building up a new and not unimportant source of revenue. Additional sales of even 25 cents a day from a thousand houses would imply enough annual revenue to be worth a large amount of effort. The one thing needful just now is hearty co-operation between the inventor, the manufacturer and the central station.

THE PROPERTIES OF TELEPHONE RECEIVERS.

The everyday experiences of telephone users abundantly demonstrate that the telephonic transmission of speech, in the present state of the art, is but semi-perfect. This imperfection in transmission, casting aside factors having to do wholly with speed, accuracy and reliability of service, consists of a deficiency in clearness or intelligibility, arising from the unequal attenuation of the different voice frequencies which are present in speech. Distortion of this character takes place at almost every point in a telephonic system where the transmitted energy changes its form, commencing with the diaphragm of the transmitter, and next the microphone, then the induction coil, the line itself, many intermediate devices and equipments, such as repeating coils, condensers, relays and the like, and finally the electromagnetic receiver with its diaphragm. Line distortion has received the attention of many investigators, commencing more than twenty years ago with Heaviside, but has never constituted a major obstacle to effective transmission and is quite satisfactorily under control in the present development of the art. Among a limited few it has been appreciated for more than a decade that the really prolific sources of distortion reside in the terminals; that is, in the transmitters and receivers. Nevertheless, little progress has been made in isolating and removing these causes of unequal or selective attenuation until quite recently.

The point of initial attack is quite naturally at the diaphragm, where both the initial and the final transformations of energy take place, but not under comparable conditions. The preliminary researches of Dr. J. B. Whitehead and Mr. C. F. Meyer, presented in their recent Institute paper, take up the problem along this line and show very clearly that the natural period of the diaphragm exerts a strong effect in apparatus of the types now standard. When a simple harmonic force of adjustable periodicity and constant intensity is impressed on a circular diaphragm, the amplitude of oscillation is non-uniform and exhibits one or more sharply accentuated peaks. They found that a receiver diaphragm, clamped at the edges, has a single characteristic peak, but a typical transmitter diaphragm,

restricted by the usual damping springs, was characterized by a double peak. The interesting case of a diaphragm under radial tension, which materially increases the sensitiveness of the ordinary type of receiver, was not considered, or at least no results were announced; but this phase of the problem will doubtless receive the early attention of investigators.

Further light is thrown on the subject by the investigations of Dr. A. E. Kennelly and Prof. G. W. Pierce into the impedance of telephone receivers as affected by the motion of the diaphragms, presented elsewhere in this issue. An electromagnetic telephone receiver with its diaphragm undamped is a special case, perhaps not hitherto classified, of the general alternating-current transformer. The useful secondary output is wholly in the form of mechanical power, represented by the motion of the diaphragm. By measuring the effective impedance of a telephone receiver, first with its diaphragm damped and again with it free, the authors obtained their so-called motional impedance, or the difference between the impedances damped and free. They show that this motional impedance very closely approximates certain definite laws of a relatively simple character. These investigations bring out the important fact that the free resistance and reactance undergo marked changes as the frequency passes through the natural period of the diaphragm, and confirm the conclusion that the present type of telephone receiver falls far short of the ideal requirements. The practical value of these researches lies not so much in the direction of eliminating the sources of distortion in transmission as in revealing and clarifying the phenomena which occur. Apparently a rich field of research has been opened and the means are at hand for continuing many interesting and profitable experiments with modifications of the present type of receiver structure. Several changes suggest themselves almost at once, such as altering the natural period of the diaphragm, modifying the shape and number of the pole pieces and changing their location with reference to the center of the diaphragm. The results of attempts at progress along these lines will be awaited with much interest.

INTERPOLE TRACTION MOTORS.

A report on the use of interpole motors for traction purposes read before the recent International Tramways Congress in Christiania gave a very encouraging view of the good qualities of this type of machine. This report, abstracted in the *Digest,* was made by M. Bacqueyrisse, in charge of an important portion of the Paris tramway network, and gave the result of considerable experience on this and on other systems. The chief advantages cited are to a certain extent familiar. They are chiefly sparkless commutation, lessened wear of commutator and brushes, freedom from the danger of flashing over at the commutator in the careless handling of the controller, and in addition material advantages in motor design, since extreme saturation of the magnet cores is no longer necessary. This permits not only reduction of magnet losses, but also regulation by shunting the field magnets, which gives a greater range of economical speeds than would otherwise be obtained. Perhaps the point of greatest interest in the larger aspect of the matter is the greatly increased facility of design for voltages much exceeding the usual figure. High-voltage direct-current systems are in fact almost dependent on interpole construction for the success that is beginning to attend them.

As a matter of fact, the reports of the various French companies using interpole motors thoroughly reinforce the facts which may properly be deduced from the general theory of the matter. Bacqueyrisse examined reports from forty-five tramway companies employing nearly 1700 equipments of this character in a total of about 6800. Some very interesting figures are furnished regarding the weights of the old and new types of motors. In most cases the change to the interpole form was accompanied by increase of power, varying from less than 10 per cent to more than 200 per cent. This of itself would have some effect on the weight per unit power, and besides the effect of size one must reckon with the effect of changed design, especially with reference to lowering the magnetic flux density in the field magnets for the sake of gaining advantages in regulation. All things considered, however, the interpole motor makes a very good record as to specific weight. As a general thing the weight of the interpole motors appears not to have increased proportionately with the increase of output, although in a few instances a slight increase of this sort has appeared, indicating probably that the advantages of interpole construction were directed in these instances chiefly to other ends than increasing the output per unit weight. In most of the cases cited, however, the gear ratio was slightly increased with the new motors, which probably accounts for part of the gain. The testimony that sparking is practically suppressed in the interpole motors was universal in all the companies investigated; even in the case of heavy overloads the tendency to sparking was very slight.

Nearly all the installations showed very much decreased wear on the commutators and correspondingly long life of the brushes. Figures indicated that the brush life was almost doubled in the commutator-pole motors. A number of the companies which contributed information were using shunt control in the interpole motors with very material advantage in the saving of energy, estimates of the actual energy saved by the new type of machine varying from 5 per cent to as high as 15 per cent, based on the cost of energy furnished. Figures based on measured consumption of the cars showed, on the whole, even slightly better results. Experience, too, with the interpole motors showed for conditions of approximately equal use lower temperatures to the extent of from 10 deg. to 15 deg. C. for the interpole motors.

Reports from this foreign source are extremely encouraging and confirmatory of the best American practice. The commutating pole is in itself an old device, but it is only within recent years that it has been worked out so as to do the work of which it is theoretically capable. There is no reason why it should not be much more widely used than is now common, and favorable reports of extended practical experience such as those before us cannot fail to have a good effect on motor design as a whole.

HOT SPRINGS CONVENTION OF ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

(By Telegraph.)

Fair weather and an attendance of approximately 250 marked the opening of the twenty-eighth annual meeting (thirty-third convention) of the Association of Edison Illuminating Companies at the Homestead Hotel, Hot Springs, Va., on Tuesday, Sept. 10. The greater part of the delegates arrived on Monday and took part that evening in the reception by President and Mrs. George H. Harries, which was followed by dancing and refreshments. The sessions were held morning and evening in the Casino near the hotel, the afternoons being given over to recreation and sports.

As has been the custom heretofore, none but vouched-for delegates was permitted to enter the meeting room. The great paper of the convention was the report of the committee on incandescent lamps presented at the session on Wednesday morning by the chairman of the committee, Mr. J. W. Lieb, Jr., of the New York Edison Company. The report of the lamp committee has always been the feature of Edison gatherings for many years past, but it was freely admitted that the report this year was the greatest one of its kind ever presented before any technical body. Even in its abridged form over two hours were required to place it before the meeting and another hour was spent in discussing it.

The first session of the convention began on Tuesday morning with an address by President Harries. After touching briefly on the lamp-testing practice of the association, he referred to the lamp-renewal policy, which provides the ony method by which the members of the association can assure for their consumers the best the lamp market affords. For the central station to loosen its hold upon lamp distribution would, in the opinion of the speaker, be short-sighted, since its reputation for efficiency would then be in the keeping of those who would make lamps merely to sell. That the relationship between the manufacturers and the central station is not as cordial as it might be is suggested in the attitude of a manufacturer who complained that by cutting the price of electrical goods which it is enabled to buy in large quantities, and hence at lower cost, the central station takes away from the manufacturer a part of his business and position as fundamental as a trade-mark, practically ruining a trade which the manufacturer has built up at great labor and expense. A statement has been made that the manufacturers' profits are getting to such a low point that it is with them a serious question whether they can continue to expend such large sums as in the past in developing and improving the art, in publicity and in many ways which as a whole have been of great value to the central station. President Harries stated that any business procedure on the part of central stations which makes it more expensive or difficult for the manufacturers to do business and secure a fair profit reacts to the ultimate disadvantage of the central station. He then contrasted the present business conditions with those of other years when a presidential campaign caused serious depression. In the face of the most upsetting political complications business this year is moving onward and it does not intend to be quadrennially scared out of a year's growth; the honest, hardworking dollar has declared its independence of politics.

Passing to the serious and practical side of the business of the industry, President Harries said that it is probable that no deliberate body has devoted more thoughtful energy to economies of operation than has the Association of Edison Illuminating Companies, yet the results achieved are not entirely satisfactory. With comparatively cheap fuel the practice in this country, in the estimation of the speaker, has lagged considerably behind the best European practice as to prime movers, disregarding an extravagance in coal which would be impossible to our transatlantic brethren. To the elimination of this waste, he said, the industry is now addressing itself seriously and with gratifying prospects of success. To that business intellect which relentlessly scraps good machinery as soon as better machinery is available is being added the wisdom of the older peoples, to whom the least valuable of coins has always been important and who consequently have insisted upon the last fraction of mechanical efficiency. This blending of method, he thought, will surely enable the industry to meet in a manner mutually satisfactory the growing public demand for the best possible service at the lowest reasonable rates.

Commenting on the constantly increasing field for utilization of electricity, President Harries called attention to an interesting phase of the campaign for complete electrification in the new domestic intermittent type of range, which will operate at a higher efficiency than any of its predecessors yet with the maximum demand reduced from about 6300 watts to 3500 watts. He intimated that the electric range operating on the storage principle has been developed to a point where there is reason to believe it will be available for sale by the beginning of the next season. Considerable further research has been found necessary to determine satisfactory metals and heat insulation before such a range can be put into regular service, but there is now good reason to believe that this problem has been successfully solved and that during the coming year there will be on the market a domestic cooking outfit operated on the storage principle, so constructed on the unit plan as to be adapted for a considerable range of work. Thermal storage, according to the speaker, will be one of the great earning factors of the near future and the odds are that its effect upon load curves will be as profitable as it will be surprising to those who have not given much thought to it.

President Harries commented on the conditions of the times in the labor world and he also took note of legislation regarding compensation. He said that there is a growing clamor for a legalized minimum wage and also an insistent demand for profit sharing. Although all the suggestions emanating from the wage earner deal only with the immediate present, no one should deceive himself by imagining that the struggle for redistribution of profits is to take place at some time in the far distant future. The strife is a present one, he said, not carried on openly, except in disturbed centers, but none the less actively waged. By dealing liberally with the employee, the distrust and discontent upon which the labor agitator depends for his strength can, in the estimation of the speaker, be removed, the solution of the problem being incorporated in the "Golden Rule."

SEPTEMBER MEETING OF INSTITUTE OF RADIO ENGINEERS.

At a meeting of the Institute of Radio Engineers held at Columbia University on Sept. 4 President R. H. Marriott exhibited and described a light portable wave-meter recently designed by him for the Marconi Wireless Telegraph Company of America. He called attention to the fact that with the decrements used at present 600-m and 300-m waves do not interfere with each other, but that no decrement however small will prevent a 600-m wave from interfering with the reception of another 600-m wave. It involves a useless expense to provide a 0.2-decrement with waves limited to 300 m and 600 m. A better law would be one permitting the use of any wave-length between 300 m and 800 m with 0.2-decrement and 0.1-energy clauses.

In a paper by Messrs. W. Torikata and E. Yokoyama, of Tokyo, Japan, which was read by Prof. Oliver Goldsmith, arguments were advanced to show that it is not advan-

tageous to receive energy from both waves emitted from closely coupled transmitters, as practically the same amount of energy can be received by tuning to one peak and thereby eliminating interference.

The next meeting will be held on Oct. 2, at which time the report of the standardization committee will be presented and discussed. At this meeting or a later one there will be exhibited the Seibt direct-reading wave-meter which indicates the wave-length directly in the same manner as a voltmeter shows volts.

NIAGARA FALLS CONVENTION, I. E. S.

All arrangements have been completed for the sixth annual convention of the Illuminating Engineering Society at Niagara Falls, Ontario, Can., from Monday to Thursday, Sept. 16-19, 1912. An outline of the preliminary program was given in our issue dated Aug. 3. Since that time several changes have been made so that the final program is as follows:

MONDAY, 10 A. M.

(1) Addresses of welcome, by Mr. O. E. Dores, president of the Board of Trade, Niagara Falls, Ontario, and Mr. G. F. Nye, president of the Board of Trade, Niagara Falls, N. Y. (2) Response to addresses of welcome, by Mr. William J. Serrill, Philadelphia, Pa. (3) Presidential address, by Mr. V. R. Lansingh, Cleveland, Ohio. (4) Report of committee on progress, by Dr. Louis Bell, chairman. (5) Report of committee on nomenclature and standards, by Dr. A. E. Kennelly, chairman.

MONDAY, 2:30 P. M.

(6) "Recent Developments in Series Street Lighting," by Dr. C. P. Steinmetz. (7) A symposium on high-pressure gas lighting: (a) in Great Britain, by Mr. F. W. Goodenough; (b) in Germany, by Mr. Oscar Klatte; (c) in the United States, by Mr. R. N. Zeek. (8) "The Deterioration of Gas-Lighting Units in Service," by Mr. R. F. Pierce.

TUESDAY, 10 A. M.

(9) "The Methods of Research," by Dr. E. P. Hyde. (10) "The Diffuse Reflection and Transmission of Light," by Dr. P. G. Nutting. (11) "Heterochromatic Photometry and the Primary Standard of Light," by Dr. H. E. Ives. (12) "A New Method and an Instrument for Determining the Reflecting Power of Opaque Bodies," by Dr. P. G. Nutting. (13) "A Study of Natural and Artificial Light Distribution in Interiors," by Mr. M. Luckiesh.

TUESDAY, 2:30 P. M.

(14) "Tests for the Efficiency of the Eye Under Different Systems of Illumination and a Preliminary Study of the Causes of Discomfort," by Dr. C. E. Ferree. (15) "Vision as Influenced by the Brightness of Surroundings," by Dr. Percy W. Cobb. (16) "The Determination of Illumination Efficiency," by Mr. E. L. Elliott. (17) "A Proposed Method of Determining a Coefficient of Diffusion for Lighting Accessories," by Mr. E. L. Elliott. (18) "Some Reflecting Properties of Painted Interior Walls," by Mr. Claude W. Jordan.

WEDNESDAY, 10 A. M.

(19) Report of the illumination committee of the Association of Iron and Steel Electrical Engineers, by Mr. C. J. Mundo, chairman. (20) "Present Practice in Small Store Lighting with Tungsten Filament Lamps," by Messrs. Clarence L. Law and A. L. Powell. (21) "The Engineering Principles of Indirect and Semi-Indirect Lighting," by Mr. T. W. Rolph.

WEDNESDAY, 8:30 P. M.

(22) "Color Values of Illuminated Surfaces," by Mr. Bassett Jones, Jr. (23) "The Lighting of the Buffalo General Electric Company's Building," by Mr. W. D'A. Ryan. (24) "Theory and Calculation of Illumination Curves," by Mr. Frank A. Benford, Jr. (25) "Characteristics and Tests of Electrodes for Inclosed-Flame Arc Lamps," by Messrs. Allen T. Baldwin and R. B. Chillas, Jr.

ENTERTAINMENT.

On Monday evening there will be a reception and dance. On Tuesday evening the annual banquet will be held. Wednesday afternoon will be devoted to a trip on the Niagara Belt Line and an automobile ride through the New York State Reservation. For Thursday afternoon there has been arranged a trip to Buffalo.

TRANSPORTATION.

Special transportation arrangements have been made for members from New York, Philadelphia and Chicago. For New York and Philadelphia members a special parlor-car train will be run over the Lehigh Valley Railroad, leaving Jersey City on Sunday, Sept. 15, at 10 a. m. Special sleepers will be run over the Michigan Central from Chicago on Sunday at 5:40 p. m.

TWENTY-FIFTH ANNIVERSARY OF MR. EDGAR'S CONNECTION WITH BOSTON EDISON COMPANY.

President Charles L. Edgar, of the Edison Electric Illuminating Company of Boston, completed twenty-five years of continuous managerial activity on Sept. 1, 1912. On Sept. 3 the employees of the company placed on Mr. Edgar's desk a loving cup in recognition of his quarter century of service. On the reverse side is engraved an appropriate toast, "To Our President," written for the occasion by Mr. E. S. Mansfield.

Mr. Edgar received many letters of congratulation, among

Loving Cup Presented to Mr. Edgar.

them one from Mr. Thomas A. Edison, whose service he entered in 1883 at the Menlo Park laboratory. Mr. Edison wrote: "When you took hold of the Boston Edison Company, a quarter of a century ago, I expected you would give a good account of yourself, but I must confess I did not anticipate the magnificent showing that has been made by you and your company in these later days. Allow me to compliment and congratulate you on your success and to wish you many more years of useful endeavor."

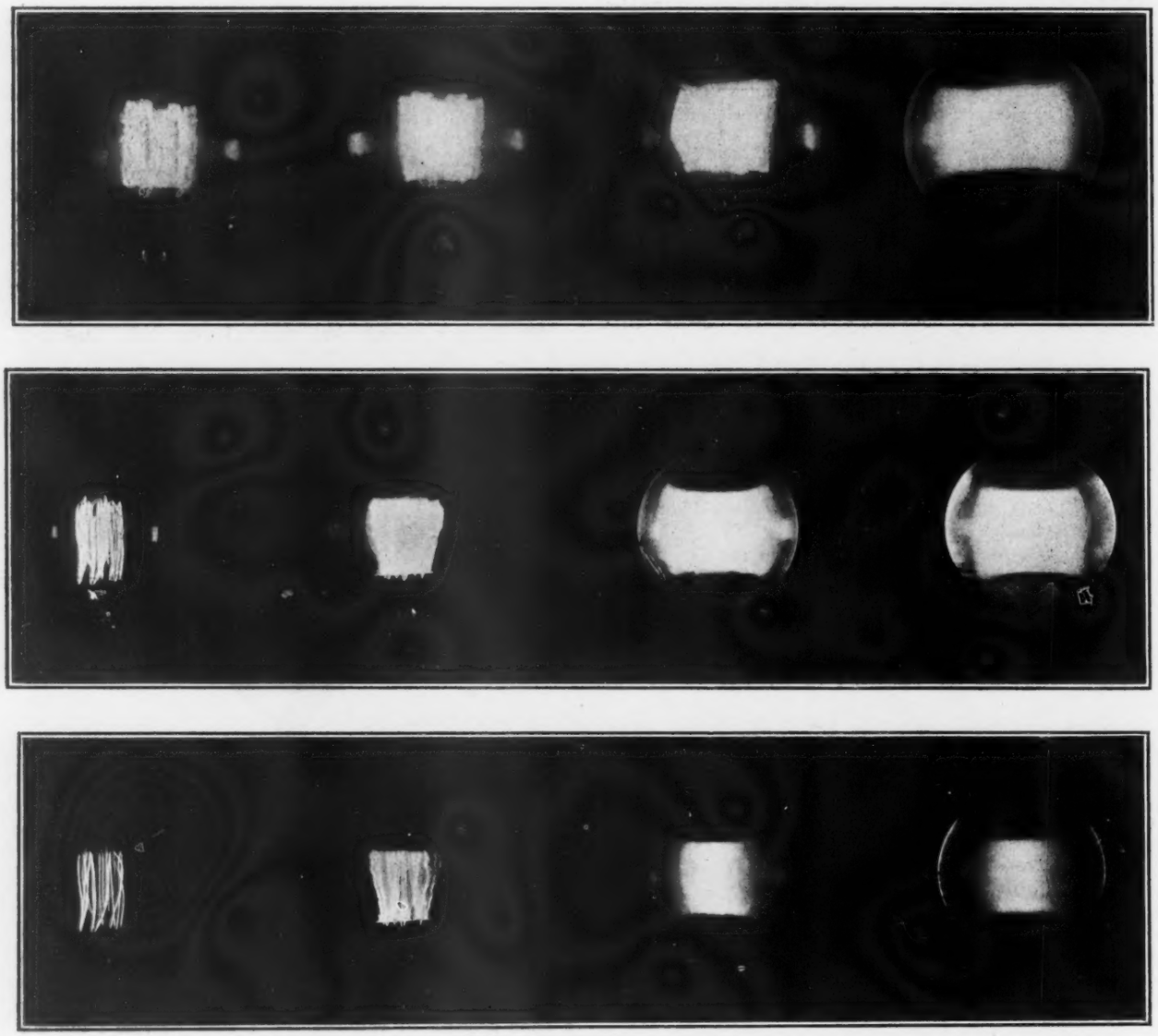
The history of the company's operations during Mr. Edgar's twenty-five years of management includes many

events of both historical and economic interest. He joined the company in 1887 as general superintendent, two years later becoming general manager and soon after vice-president. In 1900 he succeeded Mr. Jacob Rogers as president of the company. During Mr. Edgar's term the company has adopted the underground system of distribution, the multiple bus method of feeder operation, storage batteries for emergency and peak-load service and the steam turbine as a substitute for large reciprocating-engine units. The Boston Edison Company now serves forty cities and towns, with a population of more than 1,000,000 people distributed over an area of about 600 square miles. Mr. Edgar has taken an intense interest in the welfare of his employees and their families, and was the means of having his company create a welfare bureau.

COOPER HEWITT DIFFUSING LAMP.

One of the inherent objections to the filament type of lamp is the excessive glare which results when such a lamp is so placed that the highly brilliant filament comes within the range of vision. Dr. Peter Cooper Hewitt has for some years past been studying means of preventing such glare and diffusing the light without sensible loss of efficiency. A patent granted to Dr. Hewitt under date of Aug. 20 describes a highly interesting means of securing this result. The means employed consist of a series of fine, smooth, substantially paralleled grooves in the outer surface of the lamp bulb, constituting a system of prisms. These grooves may be arranged in various ways. The illustrations show lamps with grooves arranged both longitudinally and transversely.

These prismatic grooves cause a general diffusion of the light emitted by the filament as it emerges from the bulb. A partial transverse cross-section of a bulb having longitudinal grooves is shown in Fig. 6, where the size of the grooves is greatly magnified. These grooves are in actual size less than one one-hundredth of an inch in width, there being ordinarily from 100 to 120 per inch. Any incandescent lamp bulb can readily be grooved in this manner by dipping it in wax and then, after baking, ruling the desired lines in the wax by means of a simple machine. Next the bulb is dipped in hydrofluoric acid for a requisite length of time, and finally the wax is removed, leaving etched grooves in the glass. The chemical method of grooving the glass has the advantage of preventing the fractures which might occur with a mechanical method, and it is possible to apply the chemical procedure to any commercial bulb.



Figs. 1, 2 and 3—Three Groups of Lamps, Each Showing Effects of Etched Grooving at Different Stages of Completion.

Figs. 1, 2 and 3 illustrate the effects actually obtained. Each figure shows four lamps with the etching in various stages of completion. Fig. 1 shows four 60-watt, 115-volt tungsten-filament lamps, the one on the left being etched but slightly, the succeeding ones more, and the lamp at the right fully etched. It will be noted that as the etching becomes deeper the image of each filament becomes broader,

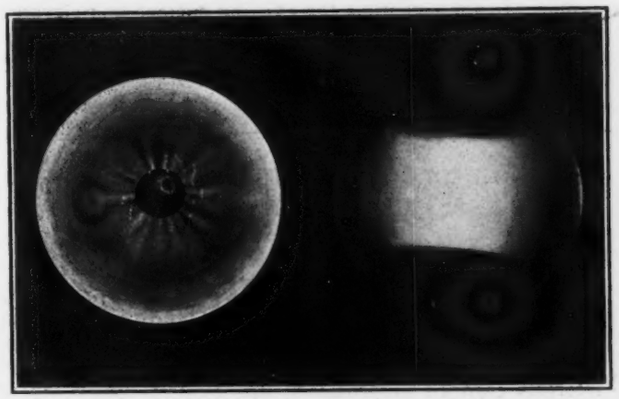


Fig. 4—End View of Lamp with Transverse Grooves, Contrasted with Longitudinal Type.

until in the final stage the whole bulb becomes luminous. Fig. 2 shows a group of 40-watt lamps, and Fig. 4 shows another group of 40-watt lamps, all being of the tungsten-filament type. The luminous edge, which can be seen in Fig. 2, is the result of etching which produces very sharp or pointed ridges between the grooves.

By means of transverse grooving the distribution of light is modified in a marked degree. Fig. 4 shows the end view of a lamp with transverse grooves, in contrast with a lamp having longitudinal grooves. The effect of the transverse grooving is illustrated in Fig. 5, which shows the candle-power distribution curves of tungsten-filament

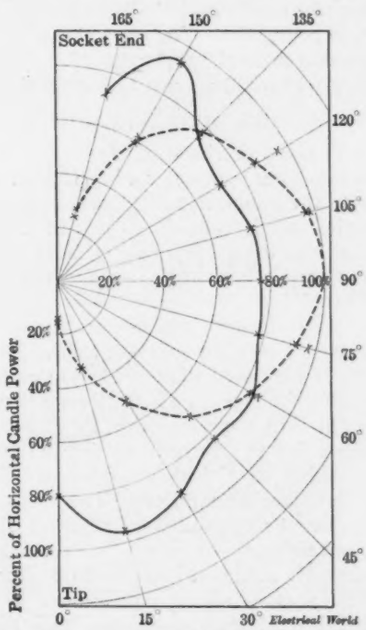


Fig. 5—Distribution of Light from Plain and Grooved Bulbs.

lamps with and without grooving. The dotted curve shows the distribution with a clear bulb, while the full line shows the distribution of an exactly similar lamp after grooving. It will be noticed that the horizontal candle-power is diminished nearly 25 per cent, while the downward illumination is greatly increased and the maximum occurs on an angle of about 15 deg. from the vertical. There is also an increase of intensity at a point considerably above the horizontal, making an angle of 150 deg. with the vertical.

Dr. Hewitt states that the loss in efficiency due to thus grooving the bulb of an incandescent lamp is entirely negligible, amounting to a few per cent at the most. One of the interesting features of the results obtained in this way is the fact that an apparently luminous bulb is pro-

Fig. 6—Transverse Section of Bulb, Showing Longitudinal Grooves, Greatly Enlarged.

duced in connection with a substantial linear source of light, such as an incandescent filament. Dr. Hewitt believes that the development of possibilities along this line has barely commenced and predicts great advances in the not distant future.

CONSOLIDATION AND EXTENSION OF ELECTRICAL PROPERTIES IN PENNSYLVANIA.

Items concerning the activities of the West Penn Traction & Water Power Company, which was formed by J. S. & W. S. Kuhn, Inc., Pittsburgh, to assume ownership of numerous electric lighting, railway and water-works properties in Western Pennsylvania, have appeared from time to time in our columns, notably on March 23, 1912, page 659; May 4, page 991; May 11, page 1038; May 18, page 1086; June 1, page 1229; June 8, page 1280; July 27, page 217, and Aug. 10, page 331. According to plans for interconnection and enlargement that are now under way and will be completed this year, the electrical system will be one of the most extensive in the country, comprising a total of 285 miles of high-tension lines furnishing energy for lighting and motor service to more than 100 cities and boroughs in western Pennsylvania. The work now under way includes the completion of the enlargement of the equipment of the Connellsville generating station and the extension of the transmission line to West Virginia. It is expected that by Oct. 15, 1912, the 28-mile transmission line from Greensburg to Crow's Nest and from Saltsburg to Vandergrift, connecting property in the Kiskiminetas Valley, will be completed. By Nov. 1 the lines from Vandergrift to Freeport and from Kittanning to Creighton, 33 miles in length, will be completed to supply energy in the Allegheny Valley between Cowanshannoc and Montrose.

Surveys have been completed for a line to extend from Freeport to Butler and the right-of-way is practically all secured. This line will supply energy to the Butler Light, Heat & Motor Company, which was purchased April 1, 1912. It is expected that this line will be completed and in operation Nov. 1, 1912. Construction has been started on the extension of the company's high-tension transmission line south of Uniontown to the West Virginia state line to supply energy to the Union Utility Company of Morgantown, W. Va. This line is about 20 miles in length and will supply energy for construction purposes on the West Penn Traction & Water Power Company's hydroelectric plant being built at the state line.

To the west and southwest of Pittsburgh the company's high-tension transmission lines from Charleroi and Washington to McDonald have been connected, and the construction of the extension from McDonald to Sewickley, a distance of 14 miles, is rapidly progressing. This line will supply energy to the properties owned by the company along the Ohio River from Coraopolis to Aliquippa. It is expected that this line will be completed and in operation by Nov. 1, 1912.

COMMONWEALTH EDISON SECTION OF THE N. E. L. A.

Despite the warm weather, there was a good attendance at the meeting of the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association on Sept. 5. This was the first meeting of the season for this section. Chairman Schuchardt, who presided, announced a proposed amendment to the constitution of the section, providing for associate section members, without a vote, to pay annual dues of $2, the dues of other members being $5. The associates—if this class is created—will participate in all the activities of the section, but will not be members of the N. E. L. A. and will not be eligible for election as delegates to the conventions of the parent association. Neither can they hold office in the section.

Mr. John F. Gilchrist, who was president of the N. E. L. A. last year, addressed the section, giving a brief review of the year's work that culminated at the Seattle convention and speaking also of the general outlook in the electric-service industry. Among other things Mr. Gilchrist remarked that during the year the membership increased from 9200 to 12,500, and that next year's convention would probably be held in Chicago. Annouoncement was made of the winners of prizes for accepted meritorious suggestions in relation to business of the Commonwealth Edison Company during the year. The N. E. L. A. orchestra, under the direction of Mr. M. L. Eastman, gave some high-class music, and an agreeable innovation was furnished in the shape of recitations by Miss Robinson, one of the employees of the company. A number of the women employees were present. It was announced that the next meeting will be held on Oct. 8, when Mr. George M. Reynolds, president of the Continental and Commercial National Bank of Chicago, will speak on "Money." The primary letter-ballot election of candidates for officers of the section is now in progress.

PLAN FOR A COMPREHENSIVE SYSTEM OF PASSENGER SUBWAYS IN CHICAGO.

In accordance with instructions from the City Council, the Harbor and Subway Commission of Chicago, in conjunction with a sub-committee of the committee on local transportation of the Chicago City Council, presented a joint report to the whole committee on Sept. 10. In this report was outlined a proposed comprehensive system of passenger subways for the city of Chicago.

The sub-committee visited recently New York, Philadelphia and Boston. Its scheme for Chicago has been worked out on the theory, based on New York experience, that the capital cost of constructing Chicago's municipal subways can be provided for in full out of future earnings. The subway routes submitted are intended to be on a basis of absolute municipal ownership and control, for all time, of the leading arteries of transportation within the city limits. The initial routes have been laid out on the theory that they may prove to be trunk lines for future feeders and extensions.

Alternating-current generation and distribution and direct-current operation of car motors are proposed. A third-rail system is to be used. All cables between the central power house and substations are to be placed in underground conduits. Where practicable these conduits will be built in the tunnel walls.

The Harbor and Subway Commission consists of Messrs. John Ericson, James J. Reynolds and E. C. Shankland. Alderman Eugene Block is chairman of the sub-committee, and his associates are Aldermen Richert, Carr, Schultz, Healy, Capitain and Twigg. Mr. William J. Shanks is secretary of the Harbor and Subway Commission, and Mr. H. H. Evans is secretary of the transportation committee.

At the meeting of the full committee on Sept. 10 it was voted that the report of the sub-committee be received (but not adopted) and that 25,000 copies be printed. No doubt there will be an exhaustive discussion in the full committee before the report is adopted, and after that there will be public hearings, the possible adoption of the report by the City Council, and then probably a referendum vote by the people. In the meantime the existing surface and elevated railway companies in Chicago will no doubt be heard on the subway proposition, so that no one can predict what the ultimate outcome will be.

CHICAGO SECTION OF THE ELECTRIC VEHICLE ASSOCIATION OF AMERICA.

At the first regular monthly luncheon of the Chicago Section of the Electric Vehicle Association of America, held at the Hotel LaSalle on Sept. 4, there were several addresses, some of them containing valuable practical hints in relation to effective co-operation between the various interests engaged in promoting the electric vehicle. Mr. George H. Jones, of the Commonwealth Edison Company, chairman of the Chicago Section, presided, and there was an attendance of about fifty-five.

The first speaker was Mr. John F. Gilchrist, of the Commonwealth Edison Company, who spoke of the marvelous development of the art since 1891 and dwelt on the necessity of co-operation. He said that perhaps $250,000,000 of capital was employed by the concerns represented by the men at the luncheon and that all of this capital is more or less interested in the promotion of the electric vehicle. This amount of monetary energy can accomplish much if aimed right. Mr. Gilchrist spoke of the advertising campaign of the association, which he commended heartily and thought would have great effect, particularly if the arguments presented at intervals in the magazines could be collected, bound up and sent in bulk, as it were, to prominent central-station companies. The central stations are waking up to the actual practical importance of the electric vehicle and ultimately will wield a great and enthusiastic influence.

NEED OF CO-OPERATION.

Mr. Louis E. Burr, president of the Woods Motor Vehicle Company, was the next speaker and addressed himself more particularly to the manufacturers and dealers. He praised the work of the association and remarked that the manufacturers, dealers and agents are having more done for them, perhaps, than they are trying to do for themselves. Furthermore, he said, the electric automobile business of to-day has become absolutely standardized and the demand is constantly increasing, both for pleasure vehicles and commercial wagons. If the associations fostering co-operation are really doing effective work, and Mr. Burr believes that they are, they might turn their attention to such practical subjects as endeavoring to stop price-cutting between manufacturers, the making of ridiculous allowances for old cars, free inspections, free repairs, etc. The speaker suggested that a committee be appointed to consider this phase of practical co-operation.

Mr. Godfrey H. Atkin, of the Electric Storage Battery Company, told a story about a policeman who stopped a gasoline taxicab on Michigan Avenue with the statement, "If you are going to burn soft coal, you must get off the boulevard." The electric vehicle, said the speaker, does not burn soft coal. Mr. Atkin urged that all interests become "boosters." Don't "knock" your competitors' cars, he said. He also remarked that local garage associations are trying to raise rates for electric garage service from $35 to $40 a month. If this is a fair charge, all the interests engaged in electric-vehicle work should be in favor of it.

COMPETITIVE METHODS OF BATTERY MANUFACTURERS CRITICISED.

Mr. E. E. Witherby, of the General Vehicle Company, agreed with Mr. Burr that vehicles should not be "given away" or absurd allowances made for old machines. He alluded to the fact that twenty-five breweries are using 399 electric trucks made by his company. The industry is now down to a solid business basis, and the speaker advocated selling the product at a fair price. In the early days electric automobiles were not built in accordance with proper engineering designs, but all that has been changed. The storage battery is the real life of the electric vehicle, and the vehicle batteries now put out are 100 per cent better than those in use ten years ago. Strange as it may seem, some central stations still consider the electric vehicle an experiment. This is surprising in view of the extensive educational campaign that has been carried on. Mr. Witherby deplored the severe competitive methods of storage-battery manufacturers.

Another drawback in the electric-vehicle business is the wretched treatment which batteries receive in the average public garage. All this can be changed by missionary work. The central stations must still be educated, and one of the first things they ought to realize is the need of using electric vehicles for their own requirements, thus practising what they preach. The National Electric Light Association might well give more attention to the commercial side of this question, for the widespread use of the electric vehicle holds out great promise for the leveling of the load curve of the average central station.

Vehicle manufacturers have convinced department stores, breweries and express companies that electric delivery wagons and trucks are good investments, but it seems to be the fact that they have still to convince many central-station managers, with the exception of some of the managers of the larger companies. Mr. Witherby pointed out, in the course of his argument, that a very small amount of space is given in the Question Box of the N. E. L. A. *Bulletin* to the discussion of the electric vehicle. This fact seems to show the indifference of the average small central-station man to the electric-vehicle industry.

POSITION OF THE GARAGE OWNER.

Mr. William L. Rudd, president of the Chicago Garage Association, which was formed about eighteen months ago, said that that association is endeavoring to encourage the use of the electric vehicle. However, it is somewhat difficult to keep the members in line, as many seem to persist in price-cutting, principally the newer members, who find, after a short experience, that there is not as much money in the garage business as they had thought. Mr. Rudd said that the advocacy of private battery-charging plants by the central stations hurts the electric-vehicle business because in private plants the cars do not receive such careful attention as they do in public garages, and thus the electric automobile gets a bad name.

Mr. Gilchrist explained that the Commonwealth Edison Company, at least, found it good business policy to encourage the public garage for battery charging. It is found more satisfactory to deal with public garages, even if the rate is low, because the demand from the public garages gives a more satisfactory load curve. Mr. Jones added that the recently adopted off-peak schedules of the Commonwealth Edison Company should be of special advantage to public garages, through enabling them to buy energy at rates low enough to permit its resale at a fair profit.

At the conclusion of the meeting motion pictures were shown representing an electric-vehicle parade in Boston, and also two photo-plays bearing on the subject, one illustrating in an amusing manner how much easier it is for a novice to operate an electric car than a gasoline car, and the other representing a lady's experience with a runaway horse and afterward her delight in an electric automobile.

CONVENTION OF PENNSYLVANIA ELECTRIC ASSOCIATION.

The fifth annual convention of the Pennsylvania Electric Association was held at the Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4, 5 and 6, the attendance being slightly over 300. A telegraphic account of the opening reception and first day's proceedings was published in last week's number. President F. M. Tait of the National Electric Light Association was scheduled to make an address at the opening session on Thursday, but was unavoidably detained in New York. Mr. T. C. Martin, however, was present to represent the national body and to make apologies for Mr. Tait's absence. He complimented the association on the program and told of contemplated geographic sections in California, Colorado and Ohio. The Georgia Section, he said, will probably be enlarged to take in four or five states, and a movement is also afoot to create a section in North Carolina, which will probably take in Kentucky and Tennessee. Mr. Martin reviewed briefly the work of the national body, which had at the time of his visit 12,345 members, and hinted at a change in its make-up. He said that the *Proceedings* this year will be divided into four sections, and that 2000 copies of the "Electric Meterman's Handbook," which was brought out for the Seattle convention, had already been sold. The convention was somewhat elated at Mr. Martin's reference to Pittsburgh as the city which might be honored with the next annual convention. The address followed the presentation of the paper by Dr. C. A. Lauffer on "Resuscitation," and Mr. Martin told of the work of the Commission on Resuscitation from Electric Shock and of the profound impression its report had made, not only on the electrical and medical fraternity, but also on the great industrial world, the association being in receipt of requests from all sources and from all quarters of the globe for the booklets and charts issued by the commission.

Mr. H. N. Muller, of Pittsburgh, and Mr. E. F. McCabe, of Titusville, asked Mr. Martin some questions about the lecture bureau, suggesting that possibly motion-picture films might be issued to the smaller companies. Mr. T. Sproule, of Philadelphia, stated that, owing to the fact that motion-picture companies asked $10,000 for the negative and 30 cents per foot for positives, such a scheme would probably be impracticable.

RESUSCITATION.

The paper on resuscitation, read by Dr. Charles A. Lauffer, of Pittsburgh, described the prone-pressure method of resuscitation as recommended by the National Electric Light Association. The author emphasized the fact that time should not be consumed in removing the body to another place, and that the work of resuscitation must be begun the instant the body is recovered from the circuit, even though other places in the neighborhood may be cleaner. He also stated that in a great majority of cases it is not necessary to know whether the victim's mouth is open, merely that the nose and mouth are free from extraneous obstruction, since the pressure on the floating ribs would force the air out of the nostrils even if the mouth were closed, and breathing can be re-established in this way. Dr. Lauffer stated that the duration of the efforts at artificial respiration should ordinarily exceed an hour and should be prolonged indefinitely if there are any evidences of returning animation by way of breathing, speaking or movement. Evidences of life are liable to manifest themselves within twenty-five minutes in patients who will recover from electric shock, and although the chances for recovery of a patient who shows no evidences of life within twenty-five minutes are rather dubious, the speaker said that where there is doubt the victim should have the benefit of it and no relaxation in the effort at resuscitation should be made so long as the least hope of success remains.

Discussion.

Messrs. E. L. Smith, Tonawanda; T. Sproule, Philadelphia; Horace Liversidge, Philadelphia; G. H. Hoffman, Philadelphia; C. R. Van Winkle, Pittsburgh; H. N. Muller, Pittsburgh; L. H. Conklin, Warren; F. F. Kellogg, Pittsburgh, and T. N. Shaw, Pittsburgh, joined in the discussion on the paper. Mr. Sproule called attention to the fact that the prevention of accidents is as essential as the resuscitation of the victim after accident, and Mr. Liversidge cited the case where victims died from electric shock on 110-volt circuits because they were taken away in an ambulance before any method of resuscitation could be applied. Mr. Conklin asked about the legal responsibility of a company which refused to allow a patient to be taken away by an ambulance surgeon, and Mr. Muller showed the shortcomings of the medical profession in the case of a man resuscitated after the physician pronounced him dead.

Following the presentation of the paper and its discussion, actual demonstrations were made on the platform of the lecture hall, and the interest manifested in these demonstrations and the willingness of nearly all the delegates to serve as subjects in their turn, while an opportunity of an actual trial was afforded to them and others under the guidance of Dr. Lauffer, showed that the central-station fraternity has been impressed by the work of the National Electric Light Association in this humane cause. Moreover, the simplicity of the method would hardly be believed by the delegates until after a personal demonstration.

DOLLARS AND FACTORS.

A paper on "Dollars and Factors," prepared by Mr. C. J. Russell, of the Philadelphia Electric Company, dealt in an elementary way with the relations between dollars and those factors affecting the economic results of their utilization, with special reference to public utilities. The author showed from statistics that for each dollar of capital invested the gross earnings of a manufacturing business were $1.12, of an electric utility not quite 15 cents, and of a retail grocer 8.87½ cents. The total expenses of the manufacturing business were 89 per cent of the gross earnings; the public utility absorbed 64 per cent of its gross earnings in expenses, and the retail grocery 93 per cent of the total income. In order to bring out the importance of the relation of these figures to each other, the author showed that if a dollar of income were added to the manufacturing business, the expenses would increase 89 cents and the net returns increase 11 cents; if a dollar of new business were added to the electric utility, the expenses would increase 64 cents and the net returns 36 cents; in the grocery business a dollar of increased gross earnings would cost nearly 93 cents in the expenses and the net returns would show a gain of a little over 7 cents.

From a consideration of these figures, Mr. Russell showed that the relation of gross earnings to capital and the relation of expenses to gross earnings are important factors in fixing the value of a given undertaking, from the investor's standpoint. He also showed by other illustrations the desirability of increasing gross earnings when their ratio to capital is from 12 to 60 per cent. Excellent information and advice are also incorporated in the paper under the titles of "Increasing Productive Capacity per Dollar of Capital," "Increasing Gross Earnings," "Load-Factor," "Diversity-Factor," "Power-Factor," "The Ratio of Expense to Gross Earnings" and "Points of Commercial Importance." The importance of increasing the productive capacity represented by a dollar in public utilities was emphasized, as well as the necessity of utilizing existing capital to bring in additional earnings. Of course, in public utilities the load-factor, diversity-factor and power-factor play important parts in this scheme, and the author showed wherein each had its effect. The paper contains much that is worthy of deep thought, study and discussion and was well received.

Discussion.

Owing to the completeness with which the author handled his subject, there was little discussion following the presentation of the paper. Messrs. E. H. Davis, Williamsport; E. F. McCabe, Titusville; E. L. Smith, Tonawanda; Van Dusen Rickert, Pottsville, Pa., and the author joined in the discussion. Mr. McCabe showed that in Titusville the addition of a load of 110 hp in motors added only 20 kw to the peak, and Mr. Russell, replying to Mr. Davis, stated that as a rule of all the additional load added to a system approximately 40 per cent appears on the station demand curve.

THE WIRING OF OLD HOUSES.

A paper on the wiring of old houses was presented in two parts, the first part, dealing with advertising, being prepared by Mr. J. E. McKirdy, of the Allegheny County Light Company, and the second part, which was devoted to a description of the methods employed in wiring old houses, by Mr. Howard H. Wood, of the same company. Mr. McKirdy outlined the publicity campaign which was conducted, largely through the daily newspapers of Pittsburgh, by the Allegheny County Light Company on the wiring of old houses without defacement. In this the company had the co-operation of an electrical page published weekly in two of the daily newspapers. The response to advertisements of the special electric-wiring offer was instantaneous, there being forty inquiries the first day in response to the advertisement in one newspaper. The results of the campaign, a description of which was published in the *Electrical World*, showed that in 1911 4000 free estimates were made and 1050 contracts secured. In the first six months 357 houses were wired, and in the last six months 698 houses, the average installation per house being eighteen 16-cp lamps. In the first six months of 1912 free estimates numbering 985 were made, from which were secured 569 contracts. This included 266 stores. During the first six months of 1911 106 contracts were given to wiring contractors, whereas in the same period in 1912 401 contracts were placed with wiring contractors.

The second part of the paper, dealing with methods employed in wiring old houses, is already familiar to our readers, they having been described at much greater length in the columns of the *Electrical World* in the issues of July 13 and 27 and August 10 and 17, 1912. As bearing upon the methods employed, Mr. Wood pointed out that in Pittsburgh, although the National Electrical Code applies, the city Bureau of Electricity has added other rules, of which the following affect the cost of wiring: (1) Each room must have an independent switch, located at the most used entrance to the room. (2) Where there is a gas outlet the switch must be double-pole (most houses in Pittsburgh are piped for gas). (3) Mains must not be smaller than No. 8 B. & S. gage. (4) Circuits must not be smaller than No. 4 B. & S. It was also pointed out that the cost of inspection was higher, and that when a central station operates in a territory subject to the rules of the National Electrical Code only it can advertise to wire houses at from $3 to $3.50 per room, while in the city of Pittsburgh the price would have to be set at from $5 to $6 per room, owing to the addition to the rules as above mentioned.

Discussion.

Messrs. E. H. Davis, Williamsport; R. H. Orr, Pittsburgh, and H. H. Wood, Pittsburgh, joined in the discussion. In reply to Mr. Davis' inquiry as to whether the company lost or made money on wiring contracts, Mr. Orr stated that in 1900 the company wired 1000 old houses at an aggregate loss of $4,000. Both Mr. Davis and Mr. Orr felt that this was good business, and that in wiring old houses a company can afford to stand a loss if thereby enough houses on existing circuits are connected to the company's system.

WELFARE WORK.

A paper on welfare work, read by Mr. B. F. Day, of the Philadelphia Electric Company, dwelt upon the change in individual and in public sentiment wrought during recent years between the employer and employee, all of which is embraced in the term "welfare work." Mr. Day reviewed the plans recommended by the public policy committee of the National Electric Light Association and said that, while the larger companies can carry on welfare work in its fullest sense within their own ranks, the work of the smaller companies may be made quite as effective through a grouping that will admit of the development of the idea on a co-operative basis, although it is not necessary to enter into any such complete industrial combination in order to secure the advantages of welfare work to the small company, especially those features referring to accident and sickness insurance and to death benefits. He suggested that the Pennsylvania Electric Association, covering in its membership so many separate companies, could, through a regularly organized co-operative plan, take up such divisions of welfare work as accident and sickness insurance and death benefits and extend them along other lines. The author submitted for consideration, as a foundation for such work, the general outline of a plan which has been in successful operation in the Philadelphia Electric Company.

Discussion.

Messrs. G. H. Hoffman, Philadelphia; H. Harris, Wilmerding; Van Dusen Rickert, Pottsville; R. H. Dutton, Hanover; T. Sproule, Philadelphia, and C. E. Titzel, Lancaster, discussed the general proposition of welfare work from many points of view, many seeking light on how such work could be inaugurated by small companies. Mr. Hoffman made a stirring speech showing the advantages of such humanitarian movements to the Philadelphia Electric Company and the effect on the company's employees. Mr. Titzel also told of the work of his company at Lancaster and the excellent results attending it. The paper and discussion indicated that the subject is a live one and worthy of further investigation, and a committee on welfare work was appointed to follow up the matter.

POWER FACTOR, ITS EFFECT ON OPERATION AND THE MEANS FOR ITS IMPROVEMENT.

The paper on power-factor, prepared by Mr. F. W. Jewett, of the Wagner Electric Manufacturing Company, St. Louis, Mo., was somewhat similar to those read before other conventions by the same author. After describing the ill effects of low power-factor on generator rating, generator field current and rotor losses, as well as on regulation, he appended a description of a unity-power-factor motor now on the market, which operates at 100 per cent power-factor at full load, and which under fractional loads will supply leading current to distribution lines. The latter will, of course, correct a corresponding amount of lagging current for machines already installed.

Discussion.

Owing to the similarity of Mr. Rickard's, Mr. Jewett's and Mr. Russell's papers, a general discussion was had on all three. Those contributing to the discussion were Messrs. E. F. McCabe, Titusville; L. H. Conklin, Warren; G. B. Tripp, Harrisburg; C. E. Titzel, Lancaster; F. Woodring, Meadville; H. Harris, Wilmerding; G. F. Wendle, Williamsport, and E. H. Davis, Williamsport. Mr. McCabe emphasized the advantages of unity-power-factor in making rates, and Mr. Conklin expressed the opinion that engineering problems are not so important as the acquisition of business to improve the load-factor, and in this respect said that the paper of Mr. Russell is an excellent one for close study by central-station solicitors. Mr. Tripp also voiced the importance of loading up existing lines and showed what was done in Colorado City, Col., where he was previously stationed, in improving both the power-factor and load-factor by inducing a company, through a low rate, to install large synchronous motors in its mills. Mr. Titzel said that the trouble with most manufacturers is that they do not appreciate what their energy costs are, and that the central station oftentimes makes a mistake in taking the business at too low a rate. By a thorough investigation a company can discover what its actual service is worth to the manufacturer, and it is the policy of the Lancaster company not to sign a contract with a customer for motor service unless it is able to do the customer some good. Mr. Titzel felt that any other policy would be foolish and react on the central station eventually to its detriment. Mr. Jewett called attention to the fact that a rate scheme at present in force in Cleveland, Ohio, takes into consideration the power-factor of the load, and Mr. Conklin doubted the advisability of complicating rate schemes with power-factor stipulations, except for small companies.

HYGIENIC VALUE OF OZONE.

A paper on ozone, prepared by Mr. Randolph Troy, of the supply department of the General Electric Company, was read by title only. Incorporated in the paper was a description of a household ozonator, together with dissertations by physicians on the place of ozone in therapeutics.

PRESIDENT-ELECT VAN DUSEN RICKERT.

ELECTION OF OFFICERS.

After the usual resolutions thanking those who prepared the papers and others to whom the association was indebted for numerous courtesies in connection with the convention, the nominating committee made its report and the following officers were elected on its recommendation: President, Mr. Van Dusen Rickert, Pottsville; vice-president, Mr. Duncan T. Campbell, Scranton; secretary, Mr. Walter E. Long, Philadelphia; treasurer, Mr. W. C. Anderson, Plymouth; executive committee one year, Mr. N. H. Spencer, Warren; executive committee two years, Messrs. W. R. Kenney, Connellsville; Thomas Sproule, Philadelphia, and E. F. McCabe, Titusville.

Mr. Van Dusen Rickert was born in Pottsville in 1869. He was graduated from Princeton University in 1892 with the degree of civil engineer and for a time was engaged in the railroad contracting business with his father, Mr. Thomas H. Rickert. In 1900 he was made manager of the Edison Electric Illuminating Company of Pottsville, and in 1906 became general agent of the Eastern Pennsylvania Railways Company, which absorbed the Edison company with the consolidation of the trolley and lighting interests of Schuylkill and Carbon Counties, Pennsylvania, by J. G.

White & Company. He was later made assistant manager of the consolidated company under Mr. W. B. Rockwell. The Eastern Pennsylvania Railway Company supplies electric service to Palo Alto, Mount Carbon, Minersville, Fort Carbon, Orwigsburg, Gerardville, Frackville, Gilberton and Cressona. Mr. Rickert was secretary and treasurer of the Pennsylvania Electric Association for two years and was elected vice-president at the convention last year. He has been an assiduous worker for the association ever since its inception, and his election to the presidency met with the unanimous approval of the association.

ENTERTAINMENT FEATURES.

Entertainment features in abundance were provided during the week of the convention. On Wednesday morning there was a card game for the ladies, and in the afternoon there was a golf tournament, together with tennis playing and swimming. The evening was devoted to a vaudeville and moving-picture performance in the open air, and the entertainments for the day concluded with dancing in the ballroom of the hotel. On Thursday an automobile trip was provided for the ladies through the mountain roads, and in the afternoon court golf and bowling were also provided for their amusement. Owing to the crowded condition of the hotel, the convention dinner, which was scheduled for Thursday evening, had to be abandoned, and the guests spent the time in singing and dancing. On Friday morning the ladies again engaged in playing cards, and in the afternoon, after the convention had adjourned, there was a golf match between central-station members and associate members. Bowling was also provided for those who cared to engage in that pastime. As was the custom, prizes of all descriptions were contributed by various manufacturing companies, the total number of prizes being seventy-five. With the exception of three loving cups all were of an electrical nature.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

A brief note on the opening session of the International Congress of Applied Chemistry in Washington appeared in our issue dated Sept. 7. The real work of the congress began upon the arrival of the delegates in New York after their trip to Washington. The professional sessions were held in twenty-four different sections dealing with various branches of the subject. For each section there was a president, a vice-president and a secretary, the officers of the electrochemical section being Dr. William H. Walker, Prof. C. F. Burgess and Dr. E. F. Roeber.

The section on electrochemistry held its first meeting on Friday, Sept. 6, the first paper being one by Dr. C. C. Fink, of the General Electric Company, Harrison, N. J., entitled "Ductile Tungsten." This paper dealt with the applications of ductile tungsten not only in incandescent lamps but also for other industrial purposes, such as resistors in electric furnaces, gauze for separating solids from acid liquors, targets for X-ray tubes and standard weights.

A paper by Dr. Carl Hering, Philadelphia, entitled "Simplifying Calculations by the Proper Choice of Units," contained interesting suggestions relating to the use of electrical units or their equivalents in all physical calculations.

Some observations on base-metal thermocouples were outlined in a paper by Prof. O. L. Kowalke, of the University of Wisconsin. The investigation reported covered the variations in emfs of nickel, iron, aluminum, copper and manganese thermocouple combinations.

A paper by Mr. Charles Burton Thwing, Philadelphia, Pa., dealt with a device for maintaining any desired temperature in a small electric furnace.

Mr. D. A. Lyon, Pittsburgh, Pa., presented a paper in which it was shown that electric furnaces for the reduction of iron ores now in use have a combined rating of 32,500 hp. He claimed that the electric furnace with energy at $16 per kw-year can compete with the blast furnace with coke at $6 per ton.

Papers on electric furnaces were presented before a joint session of the mining and metallurgy, electrochemistry and conservation of natural resources sections on Saturday, Sept. 7. One of these, by Mr. Paul Heroult, covered recent developments in the electric steel furnace. In Europe the process has been developed for high-priced steels, but in the United States the principal problem has been that of making rails.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The past week was signalized by the beginning of street surface car operation over the Manhattan Bridge across the East River. This bridge has been completed for three years, but up to this time had not been used except for roadway and foot traffic. The first company to start operation was the Manhattan Bridge Three Cent Line, an independent company which was organized in Brooklyn for the purpose of providing cheap transportation from the business center of Brooklyn across the Manhattan Bridge to the business district of Manhattan. The company received a certificate of convenience and necessity from the Public Service Commission for the First District more than two years ago, but this was attacked in the courts by the old transportation lines, and the litigation lasted until June of this year, when the new company got a franchise from the Board of Estimate and Apportionment for the operation of cars over the bridge, but not for that part of the line running through Manhattan. This franchise was approved by the Public Service Commission, and under this authority the Manhattan Bridge Three Cent Line began operation last week. The service promises to prove popular, as more than 3000 passengers were carried the first day of operation.

The old transportation companies meanwhile have been active in pressing applications for rights to operate over the same bridge. The New York Railways and the Third Avenue Railway companies on the New York side of the river joined with the Brooklyn Rapid Transit and the Coney Island & Brooklyn companies on the Brooklyn side and formed what is known as the Brooklyn & North River Railroad Company. This company received a certificate of convenience and necessity for a street railroad over the bridge from the Public Service Commission this summer and has applied to the Board of Estimate and Apportionment for a franchise. Meanwhile the individual companies composing it secured from the commissioner of bridges a temporary permit to operate over the bridge, and, pending the grant of a franchise to the Brooklyn & North River Company, they have applied to the Public Service Commission for permission to operate one line over the Manhattan Bridge under the bridge commissioner's permit. The commission is now holding hearings on this application.

MARYLAND COMMISSION.

The Maryland Public Service Commission last week signed an order requiring the Chesapeake & Potomac Telephone Company to show cause before Sept. 13 why the flat-rate service limit, which expires Oct. 1, should not be extended to April 1, 1913, at the option of the subscriber. This is the second step in the action begun last week by the Protective Telephone Association. This organization filed a petition for an extension of time on the ground that the investigations that it was making convinced it that not only are Baltimore rates for measured service excessive, but that a large majority of important municipalities have a flat-rate service. Should the extension be granted, it is the purpose of the Protective Association to submit evidence that will convince the commission that un-

limited service in the business districts of Baltimore should not be abolished.

After nearly two months of investigation by the commission into the rates charged for gas and electricity by the Consolidated Gas, Electric Light & Power Company, the taking of testimony is believed to be nearing the end. Beginning with the testimony of James J. Lindsay and Archibald Bowman, of the accounting firm of Marwich, Mitchell, Peat & Company, the counsel for the people, Mr. Albert C. Ritchie, has attempted to show that the physical valuation placed on the property of the company, amounting to nearly $26,000,000, was about $12,000,000 in excess of the actual cost. He also tried to show by the testimony of experts and of Vice-president Cohn that the several consolidations had resulted in a capital inflation of nearly $10,000,000. Secretary William Schmidt, Jr., on behalf of the company, offered in evidence a number of letters from leading banking houses of the country setting forth what ratio the net earnings should bear to the fixed charges in order to maintain the value of outstanding securities. In a number of the letters the opinion was expressed that net earnings equal to one and one-half times the fixed charges would maintain the current value on securities. At once Mr. Ritchie pointed out that the net earnings of the Consolidated last year were $2,822,400 and that the fixed charges amounted to $1,417,267. Computed on the basis established by the bankers, the rates should be reduced so as to produce net earnings of $2,125,000, or nearly $700,000 less than those of last year. The developments of the last few weeks seem to indicate that the Consolidated will base its principal defense of the present rates on the ground that they are necessary in order to uphold the value of the securities. Counsel for the company have presented evidence tending to show that the Consolidated is planning vast extensions within the next five years which will cost on an average more than $1,000,000 a year.

OHIO COMMISSION.

The Public Service Commission of Ohio has formally approved the joint application of Messrs. Charles Ash, Charles A. Strausch, Ira Cadwallader, Charles L. Guernsey and Earl Ash, doing business under the firm name of the Standard Light & Power Company, for permission to sell the company's property to Mr. Field W. Swezey. The plant of the Standard Light & Power Company is situated in the city of Fostoria, Seneca County, Ohio. The consideration is $82,500.

A ruling was made recently by the Public Service Commission to the effect that when a telephone company operating between two points is able and willing to handle all the business between them it cannot be forced to establish connections with a rival company which is represented at only one of the points. This decision was occasioned by the attempt of the Hamilton Home Telephone Company to force the Cincinnati & Suburban Bell Telephone Company to furnish it connection with Cincinnati over the latter's long-distance lines. The petition was dismissed. At the hearing some weeks ago much testimony was introduced to show that the Hamilton company could rightly demand connection with the Bell lines, while on the other hand the Cincinnati & Suburban company proved that it had the facilities for taking care of the business offered between Cincinnati and Hamilton and that the Legislature did not intend, in the public utilities law enacted at its late session, to force a physical connection under such circumstances. The independent companies have never been able to obtain a foothold in Cincinnati or even establish a long-distance service that amounted to much, and this case apparently presented an opening, if any exists, to force the Bell company to connect.

MICHIGAN COMMISSION.

Judge Collingwood, at Lansing, Mich., lately denied the application of the Home Telephone Company, of Grass Lake, for an injunction to prevent the consolidation of the Home Telephone Company of Detroit with the Michigan State Telephone Company. The court set aside the contention of the plaintiff that the consolidation is in restraint of trade and that the State Railroad Commission was without authority in the matter because of the alleged unconstitutionality of the Giles law. It has been reported that the case will be appealed.

Current News and Notes

GRAZING AND WATER PROTECTION PROBLEMS.—The United States Department of Agriculture has established an experiment station on the Manti National Forest Reserve, near Ephraim, Utah, for the study of grazing and water-protection problems. It has already been proved conclusively that the over-grazed conditions of areas on which the natural vegetative cover had been seriously altered was responsible for the formation of torrents and the rapid discharge of debris-laden flood-waters. In a recent destructive storm the water ran clear from a portion of the watershed which was within the National Forest, while from other areas it swept down sand and boulders. One of the objects of the study will be to learn how the maximum of grazing use of natural forest land can be obtained without injury to forest reproduction and stream flow.

* * *

DEDICATION OF RICE INSTITUTE, HOUSTON, TEX.—Rice Institute, the new school of science, engineering, architecture and classical subjects at Houston, Tex., founded upon the ten-million-dollar bequest of William M. Rice, will be formally dedicated with exercises lasting Oct. 10 to 13, although classes will begin Sept. 23. The opening ceremonies will be attended by distinguished scholars from several foreign countries. In planning the Rice Institute courses it is declared to have been the aim to place facilities for thorough technical and professional training within the reach of all. Dr. Edgar Odell Lovett, formerly of Princeton, is president of the new institution. Mr. Francis Ellis Johnson, a graduate of the University of Wisconsin and recently associated with the Vancouver (B. C.) electric company, is announced as instructor in electrical engineering.

* * *

MONUMENT COMMEMORATING THE FIRST TELEGRAPH TRAIN ORDER.—An attractive illustrated booklet narrating the movement which resulted in establishing at the Harriman (N. Y.) station on the Erie Railroad a monument commemorating the transmission of the first telegraph train order in 1851 has been prepared by Mr. J. B. Taltavall. The Harriman station stands nearly on the site of the original Turner station from which the first order was transmitted to Goshen, N. Y., by Mr. Charles Minot, then general superintendent of the New York & Erie Railroad. The commemorative tablet was erected under the joint auspices of the Association of Railway Telegraph Superintendents and the Old Time Telegraphers' and Historical Association during May of the present year. Copies of the booklet may be obtained from Mr. Taltavall, at 253 Broadway, N. Y.

* * *

MEDAL FOR SAFETY DEVICE.—The Allgemeine Electricitäts Gesellschaft, of Berlin, has placed at the disposal of the American Museum of Safety the Rathenau gold medal for award annually for the best device or process for safeguarding life and limb or promoting health in the electrical industry. The competition is open to every country in the world, the only condition being that the device or process must be exhibited at the American Museum of Safety in New York City. One Rathenau medal will now be cast each year from the original die for the American

Museum of Safety to award. The Rathenau medal was presented to Dr. Emil Rathenau, president and founder of the Allgemeine Electricitäts Gesellschaft, on the occasion of his seventieth birthday, with the felicitations of the Kaiser for his services in the field of electrotechnics, notably in connection with the introduction of incandescent electric lighting in Germany.

* * *

Report of Buffalo Street Railway Investigation.—The Public Service Commission for the Second District of New York State has published as a separate document the 126-page report covering the investigation of street railway traffic conditions in Buffalo, N. Y., by C. R. Barnes, electric railroad inspector for the commission. An abstract of the findings was given in our Public Service Commission News, page 299, of our issue of Aug. 10. The office of the commission is at Albany, N. Y.

* * *

Reduction in Cable Rates.—Official announcement has been made of a reduction in cable rates between Great Britain and the United States and Canada, to become effective at an early date. Regular messages will cost 25 cents per word. Messages that can be sent at such times during the day or night as the company finds convenient will cost 9 cents per word. Night letters will cost 75 cents for twelve words and 5 cents for each additional word. Week-end letters will cost $1.15 for twenty-four words and 5 cents for each additional word. The rates are about 25 per cent lower than former rates.

* * *

The Japanese Tariff.—An English edition of the Japanese tariff of July 17, 1911, has just been published by the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor. This tariff marks the attainment by Japan of full independence in commercial matters. It provides for higher duties than those formerly in force, with the twofold object of increasing the amount of revenue and of offering increased protection to Japan industries. The rates of duty are given in both Japanese and American currency, weights and measures. Copies may be obtained by application to the Bureau of Foreign and Domestic Commerce.

* * *

California 1911 Metal Production.—The mine output of gold, silver, copper, lead and zinc in California during the year 1911, according to Mr. Charles G. Yale, of the United States Geological Survey, was valued at $25,174,677, representing a decrease of $1,845,728 from the corresponding value for 1910. This decrease was caused mainly by curtailment in the copper output, because of litigation over the smelter-fume question. The production of copper was 36,316,136 lb., valued at $4,539,517. This represents a decrease of 12,384,620 lb., having a value of $1,645,479. The output of lead was 1,398,111 lb., valued at $62,915. This output was only about one-half that of the previous year. No zinc was purchased in 1910, but the 1911 production was 2,807,035 lb., valued at $160,001.

* * *

Free Water-Power Permits.—According to newspaper reports, Mr. Walter L. Fisher, Secretary of the Interior, plans to grant free permits for the development of water-powers controlled by the government, provided the energy is used for municipal purposes and for irrigation, without making any rental charge. It is said that these permits will be granted under new regulations governing water-power development on public lands outside of the national forests. These regulations were promulgated by Secretary Fisher before leaving for Hawaii. It is added that the intention is to insure that the benefits which are to be conferred shall be enjoyed by the citizens of the municipalities and by the irrigators, for whom it is intended, rather than by men who may construct and operate the works.

* * *

Efficiency Society.—As noted in our issue of March 23, page 632, the Efficiency Society was organized in New York City on March 18, for the purpose of promoting efficiency in the various activities in which man is engaged. The society has recently distributed a pamphlet setting forth its purpose and organization and outlining its plans for the future. Following up the work initiated at the first meeting, it is the intention to develop the science of organization and management along lines which will lead to efficiency in industrial and other fields. The program will be a dual one, relating in part to the cure of present inefficiency and in part to the prevention of future inefficiency. The pamphlet recently distributed also includes the constitution and by-laws of the society. The present headquarters are in the Engineering Societies Building, 29 West Thirty-ninth Street, New York. Those who are interested in the movement for which this society stands should communicate with Mr. H. T. J. Porter, secretary.

* * *

Electrolytic Volts.—That electrical engineers have much to learn about electricity is indicated in the following account of electrolytic action which appeared recently in a Montgomery (Ala.) paper: "Harmful as electrolysis may be, it is one of the most interesting freaks that develop in the use of electricity. Electricity is measured by volts and amperes, volts denoting the quantity of the current and amperes its quality, or strength. It is possible for volts to escape from a distributing point, from a trolley car in the rain, and in almost any manner where the wiring may be out of order. They may come down the trolley pole or a street car in rainy weather, be picked up on the damp floor in a woman's silk petticoat, left on the metal plate of a store's door, picked up by the steel tire of a vehicle, but invariably they find their way back to the current-generating dynamo. Left a while on a piece of metal, the stray volts will feed on it, destroying it, the destruction in such circumstances being known as electrolysis. The 'disease' is something that every institution using metal pipes is constantly on guard against, as far as it can guard, but usually, as in the present instance, the damage is not found out until it is done."

* * *

SOCIETY MEETINGS.

Western Association of Electrical Inspectors.—Attention is called to the fact that the next annual meeting of the Western Association of Electrical Inspectors, to be held in St. Louis, will take place on Jan. 28 to 30, 1913, beginning one day earlier than announced recently in the *Electrical World*.

* * *

Outing of New York Electrical Contractors.—On Saturday, Sept. 28, the New York Electrical Contractors' Association will hold its outing at Donnelly's Grove, College Point, L. I. In addition to a number of general athletic events there will be a baseball game between the material men, under Captain V. C. Gilpin, and the contractors, under Captain J. C. Hatzell.

* * *

Outing of New York Companies, N. E. L. A.—The second annual outing of the New York Companies Section of the National Electric Light Association has been arranged for Saturday, Sept. 14, at Donnelly's Grove, College Point, L. I. The athletic committee, of which Mr. W. Nelson Valk, New York & Queens Electric Light & Power Company, is chairman, has arranged for a set of games to be held during the afternoon, including baseball, running and shot-putting, for which numerous prizes are offered.

SYSTEM OF THE PACIFIC POWER & LIGHT CO.

Numerous Small Generating Stations Operated in Multiple on a 66,000-Volt Line Traversing Portions of Washington and Oregon.

Typical Rural Service in the Semi-Arid Yakima and Walla Walla Valleys—Extensive Use of Electricity for Irrigation Pumping and for Domestic Purposes in Sparsely Settled Communities—Improvements in Service Incident to the Consolidation of Small Generating and Distributing Systems.

THE Pacific Power & Light Company, of Portland, Ore., operates an electric generating and transmission system in Oregon and Washington, its activities extending over the south central and southeastern parts of Washington and along the northern part of Oregon in the territory tributary to the Columbia River, extending from the Pacific Coast to the western boundary of Idaho. The company's properties are located in sixteen different counties in the states mentioned above, these counties having a total land area of 27,500 square miles, although, of course, the system of the company does not cover this much territory completely. The total population served is about 100,000 and an appreciable percentage of the total is composed of rural and farming communities.

ORGANIZATION.

The Pacific Power & Light Company is a subsidiary of the American Power & Light Company, of New York, and is therefore affiliated with the Electric Bond & Share Company. It was organized in the spring and summer of 1910 to take over a number of isolated electric, gas, railway and water plants in the Pacific Northwest. These plants varied in degree, size and physical equipment when they were purchased by the Pacific company. A large expenditure has been necessitated to put them in proper condition to take care of the increasing demand made upon them by the growth of population and by the increased business which the company has been able to develop.

Previous to the formation of the Pacific Power & Light Company the American Power & Light Company had organized the Portland Gas & Coke Company, which owns and operates the entire gas industries in Portland and vicinity. The operations of the Portland Gas & Coke Company and the Pacific Power & Light Company are carried on by the same executive officers, although separate operating departments are maintained. The Pacific company operates no properties in Portland, the electric and railway properties of that city being owned by the Portland Railway, Light & Power Company.

The more important of the companies taken over by the Pacific company in 1910 were the Astoria Electric Company, of Astoria, Ore.; the Wasco Warehouse Milling Company, of The Dalles, Ore.; the Northwestern Corporation, of Walla Walla, Wash., and the Northwest Light & Water Company and the Yakima Valley Power Company, of North Yakima, Wash. A number of smaller properties were purchased, with the result that the Pacific company now owns the electric lighting and motor-service business in the following among important towns: North Yakima, Toppenish, Sunnyside, White Salmon, Goldendale, Prosser, Walla Walla, Waitsburg, Dayton and Pomeroy, Wash.; Pendleton, The Dalles and Astoria, Ore. It also owns

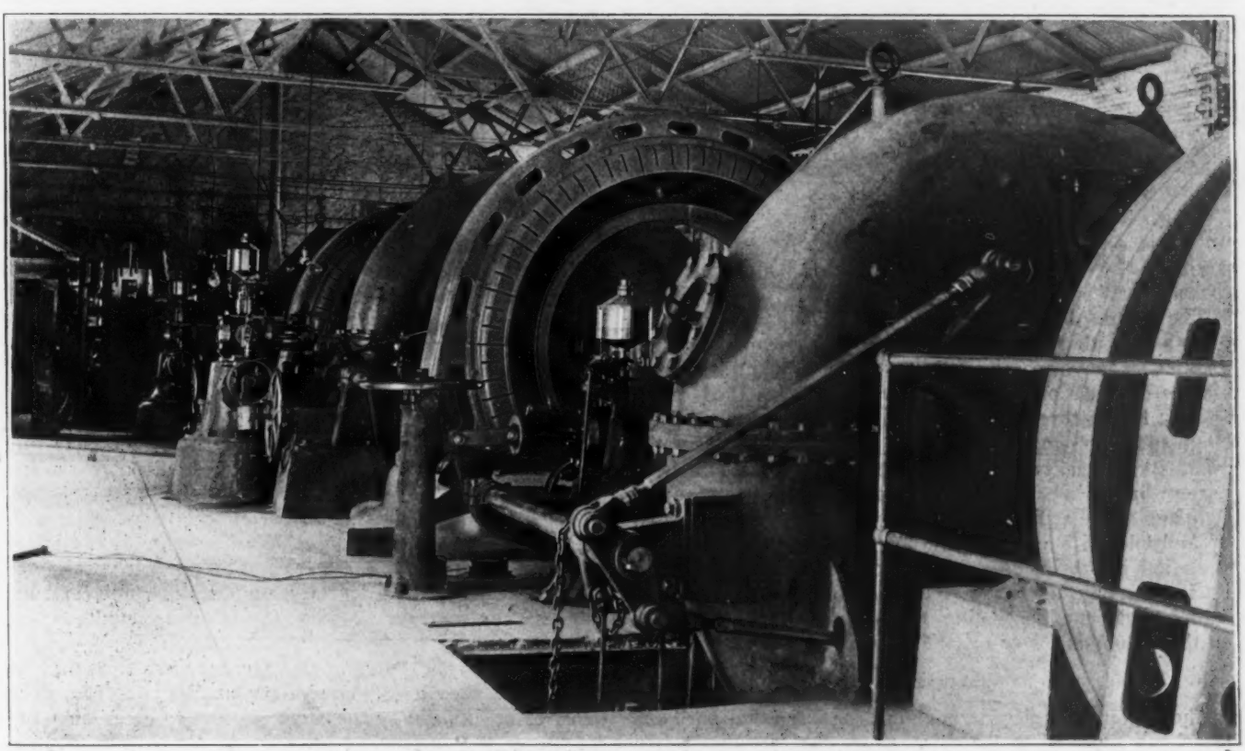


Fig. 1—Interior of White River Power Plant.

the electric generating and distributing system at Hood River, Ore., which is operated under lease by the Hood River Gas & Electric Company. It owns gas plants in North Yakima and Walla Walla, Wash.; Lewiston, Idaho, and Pendleton and Astoria, Ore., and owns the street-railway system in Astoria, together with the city water-works in North Yakima, Prosser, Kennewick and Pasco, Wash. It owns all the capital stock of the Walla Walla Valley Railway Company, which maintains a 25-mile city and interurban system in Walla Walla, Wash., and Freewater, Ore.

RURAL BUSINESS.

Since its inception it has been the policy of the company to build up its rural business, particularly the use of electricity for irrigation pumping, and the company's transmission line extends through the semi-arid Yakima and Walla Walla valleys, which are particularly famous on account of their fruit products and in which it is quite impossible to secure the best crops without the aid of irrigation. The available water supply through gravity is limited. In many cases there are large tracts of upland which are capable of producing the finest fruits and field crops when water is applied. It has been practicable to do this through electrical pumping, and the company has at the present time in the neighborhood of 4000 hp in motors connected to its lines which are pumping water for irrigators. These motors vary in rating from 1 hp to 250 hp and there

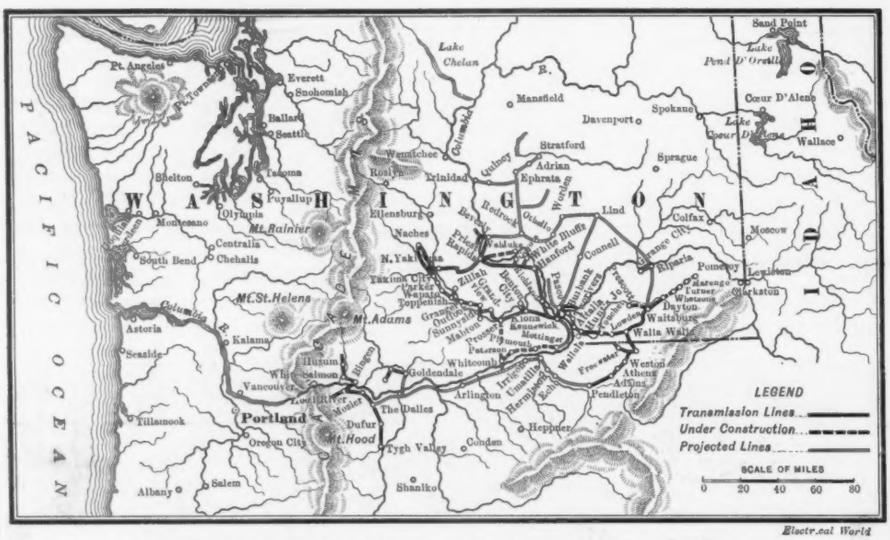


Fig. 2—Map of Territory Served by Pacific Power & Light Company.

are some single installations having a total of 800 hp. The majority of the installations are small, however, and average between 5 hp and 7.5 hp.

The Hanford Irrigation & Power Company, which is also a subsidiary company of the American Power & Light Company, operates a large pumping plant at Coyote Rapids on the Columbia River, where the installed rating is 1775 hp, in three units, pumping water through a 60-ft. head and distributing this water by means of a 20-mile main irrigation canal the greater portion of which is cement-lined. The high-tension systems of the Hanford company and Pacific company are connected and operated in multiple with each other, but this large pumping installation is not included in the 4000 hp connected to the Pacific company's system. The Hanford company has installed sufficient generating equipment at Priest Rapids on the Columbia River to take care of its own motor load.

IRRIGATION.

The features of electric pumping for irrigation purposes that have appealed to the farmers are the fact that water can be secured from wells, which means that it will be free from weed seeds and trash, and the fact that the farmer is not dependent upon the governing board of some irrigation company for his chance to use water. He can pump it at all times to suit himself, and in pumping plants similar to those installed on the Pacific company's system water can be distributed over smaller tracts entirely through pipes, with the result that a high percentage of water is utilized on account of low ditch seepage and evaporation losses.

In many cases, of course, water is pumped directly from rivers and irrigation ditches, but even in such cases the farmer has the advantage of being able to pump when he wants to and can insure the delivery of water to any part of his property. The installations more frequently employed consist of a three-phase horizontal induction motor directly connected to a centrifugal pump. The pump and the motor are mounted on the same base and in the case of wells they are located on a framework situated below the surface. Some farmers have installed vertical equipments, but these are not as popular as the horizontal arrangement. The vertical equipments have proved less efficient than the horizontal. There seems to be some difficulty in getting them properly installed, as there is a tendency for the shafts to get out of line and the excessive friction affects the operation.

RATES FOR IRRIGATION LOADS.

Energy is delivered by the company at the pump house generally at 220 volts, and the company maintains two systems of rates, one flat and one meter, there being a fixed charge in each case, however, of $12 per hp per annum for apparatus connected. In the case of the flat rate the running charge is based upon the fixed amount per hp of the customer's demand and in the meter rate upon his kw-hour consumption. The flat rate is very popular with farmers who irrigate for certain fixed periods in the summer time only and who do not use their plants at all in the winter. The meter is more popular with the farmers living in communities where total irrigation is not required and where considerable assistance is derived from the natural rainfall. These farmers, as a rule, endeavor to do more or less winter pumping and prefer the meter rate.

In some cases belt-connected motors are installed, and while these have the disadvantage of a loss in efficiency, nevertheless they have a particular advantage in that the speed of the pumps can be varied as the farmer may desire to take care of the rise and fall of his water supply, which is an important feature in some localities. The belt-driven equipment also has the advantage that the motor can be disconnected from the pump in the winter time and used about the farm for running feed choppers or any other apparatus that the farmer may desire.

The company maintains a special irrigation agent with headquarters at North Yakima, Wash., whose business it is to solicit the irrigation business and to give such assistance as is necessary to the farmers in installing their plants, although the company does not furnish the pumping equipment itself.

Other important loads in this territory are furnished by flour mills, the State Penitentiary at Walla Walla, rock quarries maintained by the State Highway Commission and the street and interurban railways in North Yakima and Walla Walla.

DIVISION OF PROPERTIES.

The electric properties of the company are divided, roughly into four sections, three of which are connected by transmission lines. The company has established a standard of 66,000-volt transmission and all of its new lines are

Fig. 3—Naches River Generating Station.

being constructed for this voltage and as fast as possible its old lines are being reconstructed whenever necessary. Practically all the distribution in the irrigated districts and in the smaller towns is at 6600 volts and energy is supplied to the irrigating customer at 220 volts, the company furnishing transformers.

Since these isolated properties were acquired by the Pacific Power & Light Company something over $3,000,000 has been spent in extending transmission lines, rebuilding distributing systems, installing additional generating equipment and extending the system generally; so that at the present time its physical properties are in excellent shape and fully capable of taking care of the present load. Much new equipment in the shape of switchboard apparatus, feeder regulators and substation facilities has been instal'ed. All of the new construction and reconstruction work has been done by the engineering department of the company.

INTERCONNECTION OF GENERATING STATIONS.

Practically all of the properties in the Yakima, Upper

Fig. 4—Power Station on Walla Walla River.

Columbia and Walla Walla divisions are tied together on one transmission and distributing system, extending from the power house on the Naches River 10 miles northwest to North Yakima on the west, to Dayton, Wash., on the east, to Beverly, Wash., on the north, and to Pendleton, Ore., on the south. This transmission system is operated from a load dispatcher's office at Kennewick, Wash., where telephone communication is maintained at all hours with the various generating stations and substations. Load dispatchers are employed night and day and hourly reports are received from all points.

The stations which feed energy into this 66,000-volt system are as follows: A plant on the Naches River above North Yakima with an installed water-power equipment of 3750 kw and steam equipment of 2000 kw; a combined steam and water-power plant of 350 kw at North Yakima; a water-power plant at Prosser of 500-kw rating; a reserve steam-turbine plant at Kennewick with a 500-kw generator; an auxiliary steam-turbine station at Walla Walla with an installation rated at 1000 kw; a water-power plant on the Walla Walla River south of Walla Walla with an installed equipment of 2750 kw, and a smaller combined steam and water-power plant at Waitsburg capable of

Fig. 5—Tygh Valley Hydroelectric Plant.

developing 75 kw. These plants are operated synchronously on the transmission system mentioned above.

In addition to the power plants outlined above, the Pacific company's system connects with the Priest Rapids hydroelectric plant of the Hanford Irrigation & Power Company, which is also a subsidiary company of the American Power & Light Company. The Hanford Irrigation & Power Company has installed at Priest Rapids on the Columbia River apparatus aggregating 1800 kw, which is also operated in multiple with the Pacific system.

There is one isolated electric plant in this division at Pomeroy, Wash., energy for which is generated on the Tucannon River about 10 miles away and transmitted to Pomeroy at a pressure of 6600 volts. A small steam plant of 100-kw rating is located at Pomeroy and serves as a reserve.

TRANSMISSION SYSTEM.

The Yakima-Walla Walla transmission system is built for

the most part of 60-ft. poles with triangle construction and without ground wire. The company has, however, adopted the use of suspension-type construction on its later installations and in such cases a ground wire has been installed at the top cross-arm. Somewhat over 41 miles of 66,000-volt line has recently been constructed with suspension insulators. The conductors on this system range from aluminum cable of approximately 55,000 circ. mils to No. 3-0 stranded copper. The company has put in a No. 3-0 copper line with the expectation that business will increase so that these heavy conductors will be necessary at some future time. Private telephone lines parallel the entire system, being installed on the same poles. Hard-drawn copper and copper-clad steel are used exclusively on the telephone system. The 6600-volt rural and irrigation distributing systems are built for the most part either of copper or of steel-cored aluminum, and the company has also installed a considerable amount of copper-clad steel and galvanized-

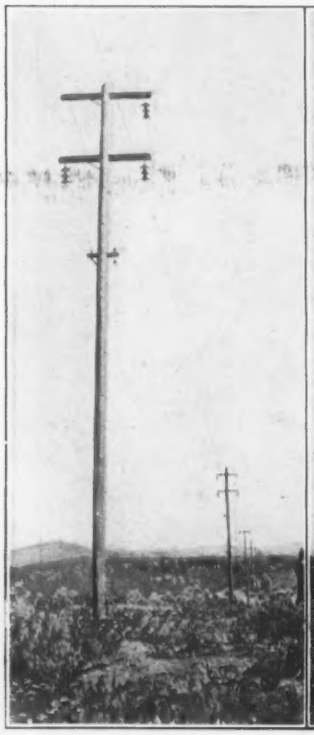


Fig. 6—Priest Rapids-Moxee Valley Transmission Line.

Fig. 7—Pasco-Walla Walla Transmission Line.

iron wire on extensions of this character. So far the results have been satisfactory.

SUBSTATIONS.

Among the important substations on the Yakima-Walla Walla transmission system is that at North Yakima, which has just been completed and has resulted in the company's being able to move the substation formerly located in its office building in the middle of the town to its power house in the suburb of Fruitvale. This substation supplies energy to the city of North Yakima, and another substation is maintained by the Yakima Valley Transportation Company where transformers are located to supply energy to the street-railway and interurban lines. The transportation company is a subsidiary of the Harriman lines and buys its energy from the Pacific Power & Light Company.

Between the Naches power house and the North Yakima and the Yakima Valley Transportation Company's substations two transmission lines have been maintained to provide for continuity of service. From North Yakima to Kennewick there are also two transmission lines, one extending eastward through the Moxee Valley by way of Priest Rapids and Hanford and the other extending down the Yakima Valley in the more thickly settled communities.

The substation at Toppenish, Wash., supplies energy to the town of Toppenish, and is connected to Wapato and Zillah by means of 6600-volt lines. The substation at Sunnyside also distributes energy at 6600 volts to a number of smaller communities. Additional substations are located at Prosser, Benton City, Richland, Hanford and Beverly, from which 6600-volt lines feed energy to a large number of irrigation customers. Another irrigation distributing system is at Freewater near the Walla Walla River power plant and another at Waitsburg northeast of Walla Walla.

The irrigation load on this system exists for practically the entire summer, the season averaging about five months, beginning in April and extending into October. More recently the farmers have been experimenting with winter pumping and it is expected that very favorable results will follow from this class of irrigation, especially in Walla Walla and Freewater territory.

LOWER COLUMBIA DIVISION.

The Lower Columbia division consists of a transmission line from a 2250-kw plant on White River in Wasco County, Ore., extending northerly to The Dalles and thence west to Hood River. There are distributing systems in Dufur, The Dalles and Hood River, and at Hood River connection is made with a 500-kw water-power plant. Part of the system is already built for 66,000-volt energy transmission. During the coming summer the line between White River and The Dalles will be reconstructed for that voltage, and before the end of the year all energy will be transmitted at 66,000 volts. The new line between White River and The Dalles will be constructed with copper-clad steel-stranded conductors on spans averaging between 450 ft. and 500 ft. with suspension insulators. The transformer stations have already been arranged to take care of the higher voltage.

The important load on this system is the flour-mill business at The Dalles, although irrigation pumping is now being developed along the territory bordering on the Columbia River between The Dalles and Hood River. A particularly interesting feature of this system is the extent of the rural distribution in the Hood River valley. The company has 6600-volt lines in this valley, which are used to distribute energy to fruit growers for many miles around.

The Hood River valley is famous in the Northwest for its apple and strawberry production and its ranches are high class and have excellent homes. The use of electricity is extensive and rapidly becoming more so. The valley lies between Mount Hood and Columbia River, is from 7 to 6 miles wide and about 20 miles long, and supports a population of 10,000 people, with the town of Hood River at its northern extremity. This territory is one of the most interesting in the Northwest from the point of view of rural distribution of electricity, although irrigation pumping is not practised here on a large scale, it being possible to grow fruit in the valley without irrigation.

Immediately across the Columbia from Hood River is located the White Salmon valley, which is somewhat similar in its geographical characteristics, located as it is between the base of Mount Adams and the Columbia River. A small hydroelectric plant at Husum furnishes electricity for the White Salmon valley and the town of White Salmon, which is on the opposite side of the river from Hood River, and here 6600-volt rural distribution is also extensive. A most interesting feature of this section is the wonderful view that can be had in either valley of the two snow-capped sentinels in the north and south—Mount Adams, which has an elevation of 12,307 ft., and Mount Hood, with an elevation of 10,225 ft.

In the center of the Klickitat County to the northeast of The Dalles is located a small hydroelectric plant on the

Little Klickitat River, which feeds energy to Goldendale and Centerville. These localities are settlements that have existed for a long time and owing to their isolation have had but slow growth. With the general waking up of such communities, however, they are gradually increasing their populations and installing the municipal improvements of other communities, such as paved streets, incandescent

Fig. 8—North Yakima Substation and Old Hydroelectric Generating Station at Right.

street-lighting systems on ornamental posts, together with city water-works and other improvements.

The coming of an abundant supply of electricity has meant a great deal to many of the smaller towns in the territory fed by the Pacific company, for the reason that they have been handicapped by being dependent upon small plants with no continuity of service. The building up of the irrigation business has been of particular benefit to many of these communities and will doubtless result in much faster growth.

ASTORIA PROPERTY.

An electric property of the company herein described last is located at Astoria near the mouth of the Columbia River, one of the oldest communities of the Pacific Northwest, founded by the original John Jacob Astor when fur trading was carried on at the beginning of the nineteenth

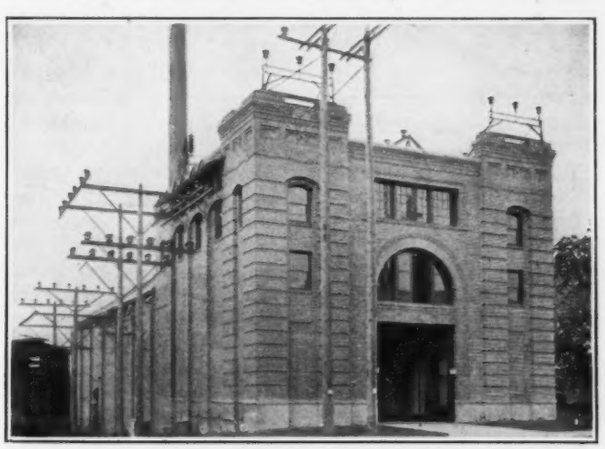


Fig. 9—Main Substation and Reserve Generating Station at Walla Walla.

century. Astoria is different from the other communities served by the Pacific company, in that it is in a more humid climate and depends almost entirely upon the lumber and salmon-fishing industries. The seining grounds at the mouth of the Columbia River furnish large catches of Chinook salmon every year and most of this catch is packed at Astoria.

The Pacific Power & Light Company has a steam plant of approximately 1600 hp and owns and operates a street-railway system and also the gas works. At the present time, however, the steam plant is not used, the energy being purchased wholesale from the Hammond Lumber Company, which utilizes its exhaust steam to operate low-pressure turbines. The lumber company's plant is located about 4 miles east of the town and energy is transmitted to the Pacific company's substation on two lines at a tension of 23,000 volts.

EXTENT OF TRANSMISSION SYSTEM.

At the present time the company has in operation about 350 miles of 66,000-volt line, classifying under this head the line between White River and Hood River, which is not now operating at this voltage but which will be by the end of summer. The company also has 73 miles of 22,500-volt lines, most of which is double circuit on a single pole line, making a total of about 125 miles of single line of this character. Not counting city distributing systems, it is estimated that the company has 250 miles of 6600-volt lines in the rural districts.

The operation of these transmission lines, between 500 and 600 miles of which are bound together in one system, was an interesting problem for the company to solve when it was first undertaken. The generating plants are not large and the charging current required by the lines was relatively high, but at the present time the load dispatcher is located at Kennewick, near the middle of the

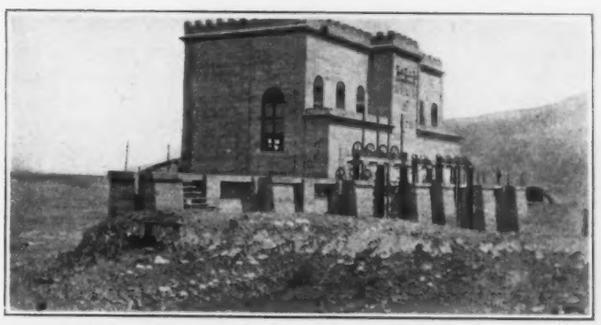


Fig. 10—Priest Rapids Hydroelectric Plant.

Yakima-Walla Walla line, which makes the situation such that it can be handled very satisfactorily. The interruptions are few. It might be mentioned here, however, that during the summer months small cyclonic wind and dust storms sometimes visit this territory and these play havoc with the transmission and distributing systems.

Some of the transmission lines extend over isolated country and to keep them properly patrolled is also an important function of the operating department. Some lines have been built over mountain ranges which have necessitated every pole hole to be blasted out of bed rock, and the line from North Yakima to Priest Rapids makes a remarkable descent from the mountains above Priest Rapids power house down the Columbia River at an angle of about 45 deg. Material for lines of this character had to be hauled many miles over almost impassable roads through rocks and sagebrush and had to be let down over cliffs with ropes.

FUTURE DEVELOPMENTS.

The American Power & Light Company interests have under contemplation the construction of an extensive development at Priest Rapids on the Columbia River, where 1800 kw is now being generated by the Hanford Irrigation & Power Company. The available power at this place has been estimated at from 100,000 hp to 300,000 hp. The river is not navigable at this point and the proposed development would include locks for the convenience of river boats, which together with the canal now being finished near

The Dalles by the government would make the Columbia River navigable from its mouth almost to the British Columbia line.

Another available source of supply for the Pacific Power & Light Company is provided by contract with the Washington Water Power Company, which stipulates that the Pacific company can extend its transmission line to Lind, Wash., and there make connections with the 60,000-volt line which has already been built to that place from Spokane. The Washington Water Power Company has an abundance of power and has arranged to make Lind the transfer point.

PERSONNEL OF COMPANY.

The Pacific company maintains general offices in Portland, where approximately sixty persons are employed, including those in its engineering and construction departments. Its general storeroom is maintained at Kennewick, Wash., and the materials and supplies are distributed from that point. The president of the company is Mr. Guy W. Talbot, who for several years was engaged in the steam-railway business in the Middle West and who had charge of the building and operation of the Oregon Electric Railway, a 75-mile interurban railway line between Portland and Salem. In 1910 the Oregon Electric Railway was absorbed by the Hill interests and Mr. Talbot was elected president of the Portland Gas & Coke Company and of the Pacific Power & Light Company. Mr. James E. Davidson, vice-president and general manager, was formerly connected with the Port Huron Light & Power Company, of Port Huron, Mich., and was later president of the Consolidated Light Company, of Montpelier, Vt. He went to the Pacific Northwest in 1910 to become new-business manager of the Pacific Power & Light Company and was later made general manager and in April of this year was given the additional title of vice-president. Mr. D. F. McGee, chief engineer, was for many years with Messrs. J. G. White & Company and operated a number of properties in the Middle West. He was manager of the Astoria Electric Company at the time it was taken over by the Pacific Power & Light Company and was made a division manager of the new company and later chief engineer. He is also vice-president of the Hanford Irrigation & Power Company and has charge of the operation of that company. Mr. Lewis A. McArthur, assistant to the general manager, was formerly connected with the Oregon Electric Railway Company, of Portland, and was made assistant secretary and treasurer of the Pacific Power & Light Company in 1910. He was appointed assistant to the general manager in April of this year. Mr. J. H. Siegfried, superintendent of power, has charge of the transmission lines and maintains an office at Kennewick, Wash. Mr. H. S. Wells has charge of the new-business department and Mr. C. H. Still is purchasing agent, both with offices in Portland.

NEW USES FOR TUNGSTEN.

Tungsten is finding an increasing use in the electrical arts outside its application in incandescent-lamp filaments. On account of its high surface tension, the metal is well adapted for sparking or arcing terminals. In some of the newer Crookes or X-ray tubes which are designed to work at enormous intensities, being capable of absorbing 10 kw and taking "snap-shot" skiagraphs of even the thickest parts of the human body, tungsten has been used as the anode target for the cathode rays, the rare metal being backed up with copper to convey away the heat developed. Although rendered molten by even this instantaneous impact of electrons, the great surface tension of the tungsten prevents its loss or change of shape. Tungsten electrodes have also been used for gas-engine spark-gaps and show longer life than those of other metals of equivalent cost.

ELECTRICAL FEATURES OF SOME CHICAGO OFFICE BUILDINGS.

Equipments for Lighting and Motor Service in Five New High-Class Buildings.

DURING the last twelve months a number of fine office buildings have been completed in Chicago. Among the most important of these, with their estimated cost, are the following: Insurance Exchange, twenty-one stories, $4,000,000; North American Building, twenty stories, $1,800,000; Otis Building, sixteen stories, $1,500,000; Monroe Building, fourteen stories, $1,500,000. Of these, the largest and costliest, the new Insurance Exchange, is served with central-station energy, while each of the other structures has its own power plant. The equipment of the four buildings is modern and comp'ete in every respect, among the utilities supplied to tenants being electric light and motor service, steam heat, hot and cold water, iced

Fig. 1—Ornamental Lighting of Entrances to Restaurant.

drinking water, vacuum-cleaner service, two telephone connections, elevator service, etc.

In the buildings served by isolated plants the plant equipment occupies the basement or sub-basement space. In the Insurance Exchange, however, such basement room has been rented to outside tenants at an advantageous rate, while deep or expensive excavation has not been necessary to provide for commercial use of the first level beneath the street. The isolated p'ants have the advantage during the winter, however, of combining their electrical and heating loads. None of the plants here listed has throw-over or break-down connection with the central-station lines, and it is imperative that the individual service of each be maintained uninterrupted.

INSURANCE EXCHANGE BUILDING EQUIPMENT.

The twenty-one-story Insurance Exchange Building, on Jackson Boulevard between Fifth Avenue and LaSalle Street, obtains its electrical energy from the Commonwealth Edison Company and its heat from the Illinois Maintenance Company, which operates the 1200-hp boiler plant in the basement during the winter months. The Insurance Ex-

change Building occupies a ground area 200 ft. square, in the center of which is an open court 72 ft. by 73 ft. The present population, with the offices nine-tenths rented, is about 2800, and there are over 9000 lighting sockets in the building.

At the second basement level and beneath the central court is the boiler room, with an overhead clear height of 25 ft. The four 300-hp Heine boilers, equipped with chain-grate automatic stokers, are owned by the building, but are leased for operation by the Illinois Maintenance Company. These are high-pressure boilers and were originally installed with the intention of operating an isolated plant. The coal bunkers are located under the sidewalk, the fuel being carted through a runway to the boilers and fired by hand onto the chain grates. The space adjoining the boiler room will be partitioned off and occupied as a substation by the Commonwealth Edison Company. Three 3500-kw synchronous converters and one 2500-kw synchronous booster will be installed for feeding energy into the down-town Edison network.

Electricity is purchased under the wholesale schedule of the Edison company and is then resold to tenants through meters at the rates prevailing for similar customers of the central station. The building management is obligated to meet any reduction in the Edison rates to this class of cus-

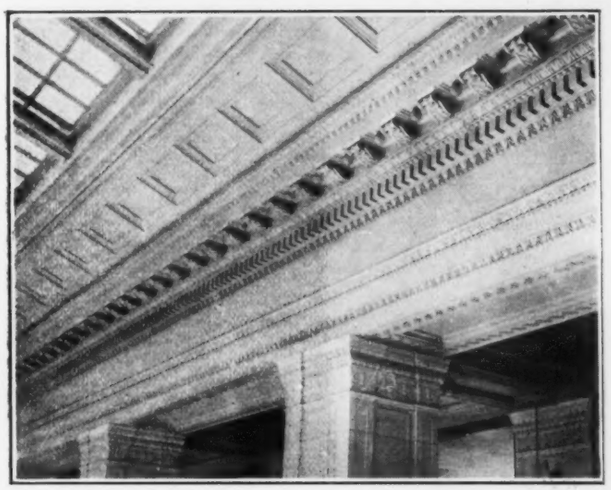


Fig. 2—Cornice Lighting in Lobby of Insurance Exchange.

tomers. Lamps, both carbon and tungsten, are furnished to tenants at the renewal rates charged by the central station. The building management owns the meters and attends to reading and billing. The Insurance Exchange is equipped throughout with Crouse-Hinds meter panels and is lighted on the unit system, using Alba glassware and a large proportion of tungsten lamps. A total of 3750 Benjamin unit ho'ders and sockets is used in the offices. Energy consumed by tenants, motors, elevators and public lighting is metered separately and recorded.

There are sixteen Otis one-to-one traction passenger elevators, each driven by a 35-hp motor and capable of a speed of 560 ft. per minute. The travel of these cars is individually recorded on odometer indicators. A contact wheel travels with the car but has its motion in one direction arrested by a ball clutch, so that movement in only one direction is transmitted through to the revolution counter. Since the car's travel upward and downward must be equal, it is necessary only to multiply this travel by two to get the total distance covered. The indicator thus gives a record of all accidental over-travel caused by running past floors and returning, thus enabling the expertness of the operators to be judged and compared. The indicator was devised by Mr. F. K. Boomhower, engineer for the building. During a representative month the sixteen passenger cars traveled 6507 miles and the freight elevator 371 miles, at an average expenditure of 4.58 kw-hr. per car-mile.

Water for the building is pumped by two 25-hp General Electric motors, each chain-connected to a Gould triplex pump. The pump motors are automatically controlled by a Cutler-Hammer magnet-operated starting panel. The supply is purified in a Manhattan water filter. Two 50-hp motors

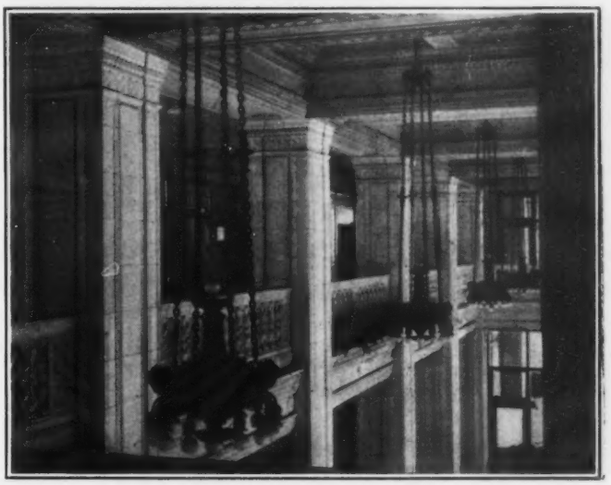


Fig. 3—Suspended Fixtures in Elevator Corridor, Insurance Exchange.

are connected to ventilating fans each capable of delivering 55,000 cu. ft. of air per minute. An air-washing outfit is also installed, but it has not been found necessary to operate this ventilating apparatus except for a small fan exhausting the toilets.

The large lobby beneath the central court is finished in white tile and is lighted by a row of 225 25-watt frosted tungsten lamps bordering the cornice. The second-story gallery which surrounds the lobby is equipped with twenty-five three-outlet bracket fixtures, one mounted on each supporting pillar. In the space in front of each row of eight elevators chain-suspended fixtures of black metal provide the illumination. Each of these ten fixtures carries eighteen 25-watt tungsten lamps, sixteen of which are arranged in a

Fig. 4—Entry Corridor of Monroe Building.

ring with central lamps pointing upward and downward (Fig. 3). These suspended fixtures measure 10 ft. from point of support to the lamps.

OTIS BUILDING EQUIPMENT.

The new Otis Building, at the corner of LaSalle and Madison Streets, is completed to its initial height of sixteen

stories, but will ultimately be extended to twenty-one stories, for which steelwork, foundations, utilities, etc., have been designed. A 550-kw isolated plant in the basement supplies lighting, motor service and heat for the building. This plant is probably the handsomest ever installed in Chicago. There are two 300-kw sets, one 150-kw set and one 100-kw set, each consisting of a Ball engine directly

Fig. 5—Cluster Lighting in Restaurant, North American Building.

connected to a Crocker-Wheeler 220-volt direct-current generator. Three-wire, 110-220-volt service for the lighting circuits is provided by two balancer sets, one of 175-amp and the other of 75-amp rating. The boiler room contains three 300-hp Edgemoor boilers fitted with automatic stokers and fed from a traveling weighing hopper which runs on rails beneath the chutes of the overhead bunkers. Coal is delivered from the underground system of the Illinois Tunnel Company, whose narrow-gage tracks, 40 ft. below the surface, duplicate in arrangement 60 miles of Chicago's downtown streets. Coal from the tunnel cars is dumped into a track hopper over the bucket conveyor which elevates the coal to the bunkers. These overhead bunkers have a storage capacity for 1000 tons, and an equivalent amount

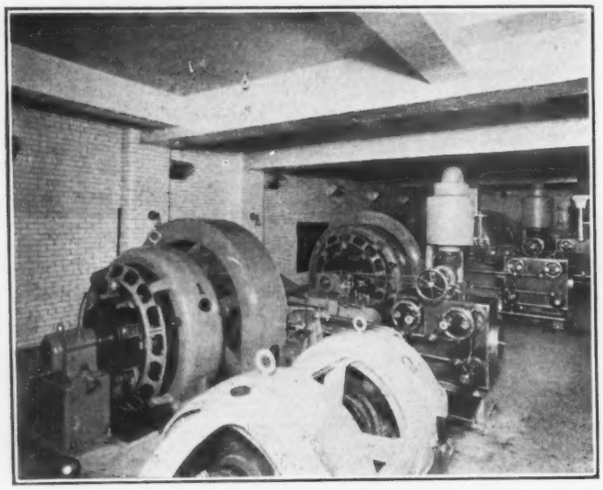


Fig. 6—Engine Room, Otis Building.

can be held on the basement level adjoining the tracks. The 220-volt trolley extension of the tunnel system is arranged with an automatic switch which normally keeps the wire in the basement "dead," energizing it when a locomotive enters and disconnecting it again when the train leaves. An electric "mule" is to be installed for switching in the sub-basement, in order to save the locomotive charges of the tunnel company. The conveyor, which has a total length of 500 ft., extends below the ash chutes leading from the furnaces, so that ashes can be delivered to the empty coal cars for removal through the tunnel. The conveyor is provided with safety switches at seven stations near the corners and mid-points of the runs, so that in case of accident an attendant can stop the conveyor from any of these points without having to run to the main switch. Before going into the conveyor for repairs he can also, by opening the nearest switch, make sure that the conveyor will not be started without his knowledge. This protection is afforded by inserting the safety switches in the holding coil of the automatic starter. If this circuit be broken, the coil releases the contact arm of the starting box, returning it to the off position, from which it cannot be moved while the switch is open.

The switchboard in the engine room was built by the Walker company and contains, besides the generator and equalizer panels, a metering panel through which the energy delivered to freight elevators, passenger elevators, public lighting, ventilation apparatus and boiler-room auxiliaries is separately measured. The distribution section of the board is divided into four parts, from which radiate twelve feeders. All motor service in the building is provided for at 220 volts, while the lighting is arranged on the 220-110-

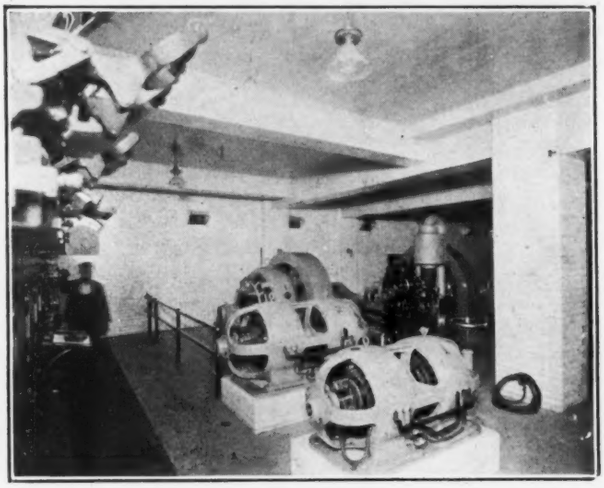


Fig. 7—Balancer Sets and Switchboard, Otis Plant.

volt, three-wire Edison system. The motor rating aggregates nearly 500 hp, 100 hp being used in the ventilating machinery alone. There are nine 3000-lb. Otis elevators, operating at a linear speed of 500 ft. per minute and each driven by a 40-hp motor. These elevators now run to the sixteenth floor, but will be extended to the twenty-first story when the building is completed in accordance with the ultimate plans.

On each floor there are two twenty-four loop Lang-McWilliams meter panels, each panel serving half of one story. The panels used are arranged with seven riser buses, and with the adjustable contact plugs any box can be balanced across the 220-110-volt, three-wire circuit to within the margin of the smallest meter circuit. When installing the service each box was balanced with the aid of instruments, with the result that the 1000-amp full load of the entire building shows a lack of balance of less than 20 amp on the switchboard meters. Electrical energy is sold to tenants at a uniform rate of 10 cents per kw-hr., regardless of the quantity used. There is no minimum monthly charge, the tenant being billed only for the actual amount of his consumption. The use of tungsten lamps is encouraged, customers being supplied at a price slightly below the market figure for such lamps. In arranging the lighting of the offices the plan has been to

rely upon overhead fixtures equipped with refracting glass reflectors for general illumination, providing in addition numerous baseboard outlets for desk and table lamps where higher intensities are required for close work. In fact, it has been stated that the total number of baseboard outlets in the Otis Building exceeds the number of ceiling outlets. The hallways are equipped with 220-volt baseboard outlets

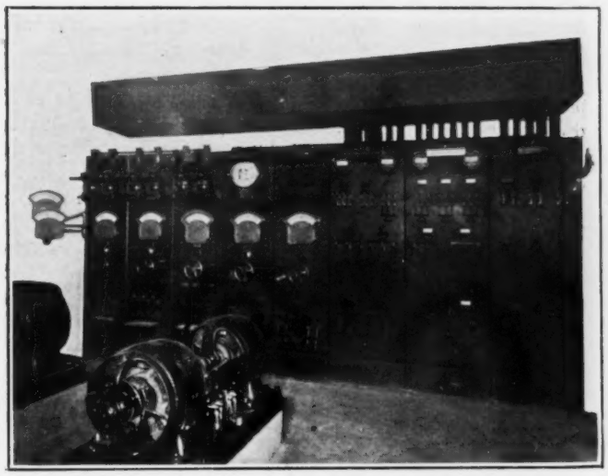


Fig. 8—Switchboard of Monroe Building Power Plant.

for the operation of portable vacuum-cleaner machines, and the public lighting in the corridors is by means of tungsten lamps in inverted glass domes. Habirshaw wire was used throughout the building. Mr. C. H. Langs is chief engineer of the new Otis Building and Mr. A. S. McKee is chief electrician.

NORTH AMERICAN BUILDING EQUIPMENT.

The new twenty-story North American Building, at the corner of State and Monroe Streets, contains a 650-kw, 220-volt direct-current isolated plant, located on a level 57 ft. below the street. The unusual arrangement of equipment in this case was made necessary by the large high-ceilinged restaurant which occupies the first basement level. Below the pantries and storeroom, four stairways down, are located the engine room and boilers. The prime-mover equipment comprises one 350-kw, one 200-kw and one 100-kw, 220-volt engine-driven set built by the Ridgway Dynamo & Engine Company. Edison three-wire service is furnished through a pair of balancer sets. The building is wired with Simplex wires and cables and is equipped with Crouse-Hinds panel boxes. A steam-driven ammonia compressor supplies refrigeration and ice for the restaurant and for the drinking water of the building. Coal is delivered to the bunkers by wagon from the street level, but there is also tunnel connection with the freight subways, through which ashes are now being removed. The North American Building was built as a novel experiment in retail merchandising, the plan being to collect under a single roof numerous small dealers working together under co-operative conditions and constituting virtually a great department store in which the departments are owned and operated by individual merchants. There are few offices in the structure, practically all the space being occupied by these retail stores. This entails a large amount of long-hour showcase lighting, so that the North American isolated plant benefits from the comparatively large day load secured. Rates for electric service to tenants are adjusted on a sliding scale which takes into account the size of the customer's installation and his hours of use. Mr. W. G. Lighty is chief engineer of the building.

The principal lighting effects used in connection with the North American Building are employed for the ornamental illumination of the entrance corridor to the elevators and in the restaurant on the basement level, which has its approach from the street. The corridor lighting comprises eight elaborate and unique bronze candelabra fixtures set in half relief into the marble with which the walls are lined. Each panel contains three lanterns individually lighted by two 60-watt tungsten lamps. The first stairway is lighted by a huge decorative bronze chandelier carrying thirty frosted 60-watt lamps, and over the outer threshold there are three 60-watt art-glass semi-indirect fixtures suspended beneath mosaic domes.

Fig. 1 shows the arrangement of the decorative lighting about the entrance to the restaurant. This piece of lighting, which in connection with the graceful design of the entrance way is declared to be very good in an artistic sense, is made up of 200 25-watt frosted lamps, 100 on each façade. Classical forms of corner lanterns mark the corner post. Within the first row of lamps in the arches are art-glass panels behind which burn tungsten lamps in reflectors. A similar plan of illumination has been employed for the ceiling of the stair entry leading down to the restaurant. The side walls are of blue tiles, and the arched ceiling is of translucent glass, behind which are mounted 25-watt and 40-watt lamps in reflectors. The dining room (Fig. 5) is lighted by eighteen gilded plaster clusters, each supporting eight 60-watt frosted lamps besides a central domed bull's-eye. On the columns about the room the fifty shell-like cap-piece designs are accentuated by five frosted carbon lamps each.

MONROE BUILDING EQUIPMENT.

The new fourteen-story Monroe Building, at the corner of Monroe Street and Michigan Avenue, overlooking Chicago's waterfront, is occupied by professional and business offices of the better class. Its isolated plant in the first basement comprises a 200-kw, a 100-kw and a 50-kw, 220-volt set, each consisting of a Sprague generator directly connected to a Skinner engine. Coal and ashes are handled by wagon directly from the street level. The generator units are provided with a specially designed com-

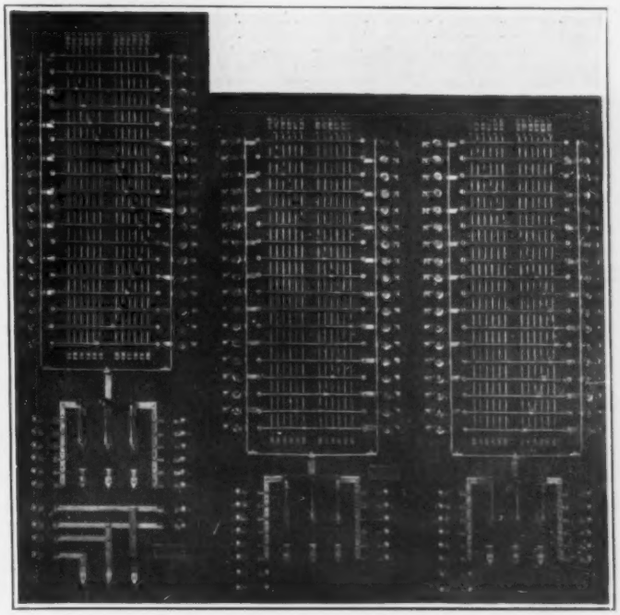


Fig. 9—Adjustable Metering Panels in Monroe Building.

pounding winding arranged to prevent voltage fluctuations on the lighting circuits due to current rushes caused by starting the seven passenger elevators. The plant switchboard, built by J. Lang & Company, Chicago, is of black Monson slate and is arranged with a double bus so that the lighting and motor loads may, if necessary, be carried on separate units. The compounding of the generators,

which was adjusted with the aid of an oscillograph, has proved to be so accurate and sufficient that the tie switch between the two bus sections has never been opened in operation. The frame of the switchboard, illustrated in Fig. 8, is of heavy angle self-supporting construction, with corner gusset plates. In the entire bus construction there is only a single bend, the switch and circuit-breaker studs being made of lengths such that straight copper may be carried from the busbars. The face of the board is lighted by linolite units with copper-finished shades. Each of the four watt-hour meters is labeled with sand-blasted letters blown on the glass case. The name-plates for the other instruments and switches are of dull copper and are attached to the slate by concealed studs. Solid copper buses have been used for connecting the wattmeters to their shunts, replacing the customary cables. Connections on the rear of the board have been designed to be most accessible. Each switch and fuse stud is inclosed in a fiber tube for safety, the polarity of the inclosed terminal—positive, neutral or negative—being indicated by one of three colors.

The Monroe Building is wired with Habirshaw wires and cables and is equipped with Lang-McWilliams metering panels. These panels are inclosed in steel cabinets of the four-compartment type, one compartment containing the metering panel for the tenants' circuits, another that for the public lighting circuits for the corridors, etc., and the other two compartments containing the meters. The bracket lighting in the attractive entrance of this building is shown in Fig. 4. The entry corridor is made up of a succession of arched domes formed of tinted tiles and is lighted by ten ornamental brackets carrying 14-in. globes, several of which are arranged with ingeniously concealed emergency gas outlets.

Messrs. Marshall & Fox were the architects for the Insurance Exchange Building. Messrs. Holabird & Roche designed the Otis, North American and Monroe Buildings, the electrical work being under the supervision of Mr. F. H. Getchell.

THE IMPEDANCE OF TELEPHONE RECEIVERS AS AFFECTED BY THE MOTION OF THEIR DIAPHRAGMS.

By A. E. Kennelly and G. W. Pierce.

THE writers have recently made a series of measurements of the resistance, inductance, reactance and impedance of various telephone receivers, at different frequencies up to 2400 cycles per second, some of the results of which are very interesting and apparently new.

APPARATUS AND CONNECTIONS USED.

The connections used are shown in Fig. 1. The telephone receiver T under test was placed in one arm of a Rayleigh bridge $A\,B\,C\,D$. The arms $A\,D$ and $D\,C$ were non-inductive resistances of 5 ohms each. The arm $B\,C$ contained an adjustable non-inductive resistance R and an adjustable Ayrton-Perry inductance variometer L. In order to obtain a balance, with silence in the head telephones H, it was necessary to adjust both the resistance R and the inductance L to values which represented the resistance and inductance of the telephone T at the frequency of the test.

The source of alternating currents was a Vreeland oscillator [1] with its primary circuit supplied from 118-volt direct-current mains. The secondary voltage was maintained constant throughout each series of tests with the aid of the electrostatic voltmeter E. The frequency supplied by the oscillator was ordinarily varied by varying the condenser c. The frequency could be adjusted to any desired value between the limits of 430 and 2400 cycles per second. The frequency, once adjusted, remained substantially constant.

[1] *Physical Review*, Vol. 27, page 286, 1908.

A non-inductive resistance R'', between the oscillator and the Rayleigh bridge, enabled the current supplied to the bridge to be controlled and computed. Calling e_t the voltage at telephone terminals and e_s the voltage at Vreeland secondary terminals, the conditions for balance, very nearly gave:

$$e_t = e_s \frac{5}{R'' + 10} \quad \text{volts} \qquad (1)$$

and this voltage e_t remained constant throughout each series of tests. In different series of tests, e_t varied from 0.3 volt to 1 volt.

The frequency of the alternating current supplied to the bridge was measured by tonometer; that is, by comparing the pitch of the sound emitted by the telephone T with that of the nearest of a series of 75 tuning forks ranging in frequency from 256 to 552 double vibrations per second, by successive steps of four vibrations per second. Having found two adjacent forks of the series between the pitches of which lay the pitch of the sound in the telephone T, the relative nearness of the two could be estimated by listening to the acoustic beats. These acoustic measurements of the frequency were checked by electric measurements of the inductance and capacity in the Vreeland oscillator circuit, and also, in one or two instances, by stroboscopic measurements of the flicker frequency of illumination from the Vreeland tube.

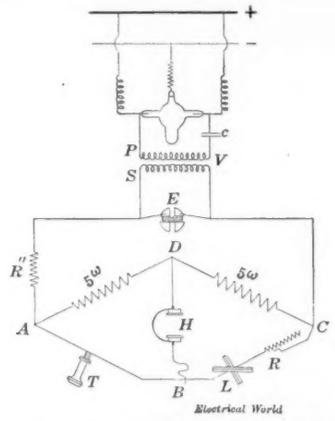


Fig. 1—Rayleigh Bridge and Connections.

MEASUREMENTS WITH THE DIAPHRAGM DAMPED AND FREE.

In making a series of Rayleigh bridge measurements of the resistance and inductance of a telephone at successively increasing frequencies it was soon found that the measured values were different when the diaphragm of the telephone was damped by pressure from the finger, so as to be incapable of vibrating, and when it was released or free to vibrate. The "damped" resistance and inductance differed indeed but little from the "free" resistance and inductance, when the frequency impressed on the Rayleigh bridge was either low or high in the range of experiment. At and near the natural fundamental frequency of the diaphragm, however, the damped resistance and inductance differed markedly from the corresponding free values, and evidently for the reason that when the impressed frequency was in consonance with the natural vibration frequency of the diaphragm the latter was thrown into powerful resonant vibration, giving out a powerful sound. This large motion of the diaphragm, in the magnetic field of the telephone, induced an alternating emf of like frequency in the telephone coils, thus altering their apparent resistance and inductance. The difference between the free and damped value of a resistance, inductance, reactance or impedance, at any given frequency, may be called the "motional" value. The motional impedance always reached its maximum at consonance between the impressed and natural vibration frequency. It varied in magnitude from 185 ohms in the case

of a certain monopolar experimental receiver down to values too small to recognize with certainty in cases of receivers dynamo-electrically very weak.

PARTICULARS OF RECEIVERS TESTED.

Four receivers were particularly investigated as follows:

(1) A Western Electric bipolar Bell telephone, type 122.

(2) A Western Electric bipolar watchcase receiver, here designated "watchcase."

(3) An experimental specially constructed monopolar receiver, with a laminated pole.

(4) An experimental specially constructed bipolar receiver provided with exploring coils and with laminated magnetic circuit.

The accompanying table contains some of the mechanical particulars of these instruments.

MECHANICAL CONSTANTS OF RECEIVERS.

	No. 1. Bell Bipolar.	No. 2. Watch-case.	No. 3. Experi-mental Mono-polar.	No. 4. Experi-mental Bipolar.
Area of each pole in cm. × cm.	1.4×0.225	1.61×0.16	0.53×0.53	1.17×0.38
Distance separating poles, cm.	0.85	0.80	....	0.73
External diameter of diaphragm, cm.	5.40	5.48	7.22	7.22
Diameter of clamping circle, cm.	4.94	4.84	4.45	4.45
Thickness of diaphragm, cm.	0.024	0.030	0.022	0.022
Weight of diaphragm, gm.	4.0	5.03	5.3	5.3
Direct-current resistance of coils, ohms at 20 deg. C.	71.0	81.4	89.7	25

OBSERVED EFFECTS OF INCREASE IN FREQUENCY ON DAMPED RESISTANCE.

It is well known that the apparent resistance of a telephone receiver increases with increase of frequency owing to the increasing expenditure of energy, in heat, through eddy currents and hysteretic losses. Figs. 2 and 3 indicate the observed changes in resistance, inductance and reactance as ordinates for the Bell and watchcase receivers respectively, with 0.3 volt at terminals, as the frequency is varied.[2] The abscissas are marked off to a scale of angular

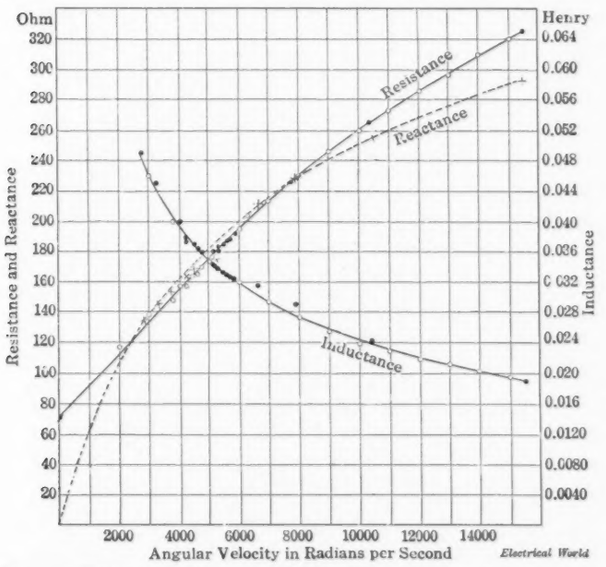


Fig. 2—Damped Resistance, Inductance and Reactance of Bell Receiver at Different Angular Velocities.

velocity ω, in radians per second, instead of frequency in cycles per second. The frequency can of course be found for any given angular velocity by dividing by 2π.

[2] A more detailed account of these measurements, giving tables of numerical values, is being published by the authors, in a paper of the same title, in the *Proceedings* of the American Academy of Arts and Sciences.

Thus, referring to Fig. 2 and the curve of resistance, the black dots indicate observed values. The damped resistance was thus 71 ohms at $\omega = 0$, and increased from 146.3 ohms at $\omega = 2760$ ($f = 440 \sim$) to 325 ohms at $\omega = 15{,}500$ ($f = 2464 \sim$).

The observed values of resistance correspond satisfactorily to the quadratic relation:

$$R = 71 + 0.0234\,\omega - 0.456 \times 10^{-6}\,\omega^2 \qquad \text{ohms} \quad (2)$$

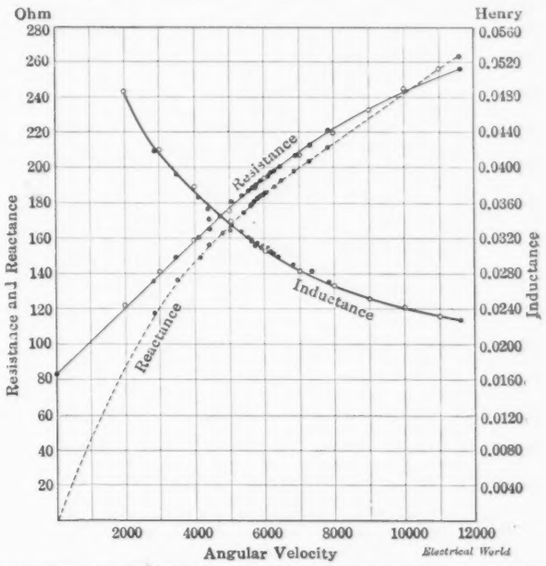


Fig. 3—Damped Resistance, Inductance and Reactance of Watchcase Receiver at Different Angular Velocities.

as is shown by the small circles on the resistance curve which indicate points computed from formula (2). In Fig. 3 the curve through the black dots of observations for the watchcase receiver corresponds satisfactorily to the similar quadratic relation:

$$R = 81.4 + 0.0214\,\omega - 0.505 \times 10^{-6}\,\omega^2 \qquad \text{ohms} \quad (3)$$

OBSERVED RELATIONS BETWEEN DAMPED RESISTANCE AND DAMPED INDUCTANCE AT DIFFERENT FREQUENCIES.

Figs. 2 and 3 indicate that the measured damped inductance falls with increasing frequency as the resistance increases. It is interesting to observe that in each case the product of the damped resistance and damped inductance remains approximately constant over the entire range of frequencies used, or the product is independent of the frequency over this range. Thus for the Bell receiver of Fig. 2, at 0.3 volt,

$$L = \frac{6.25}{R} \qquad \text{henrys} \quad (4)$$

and for the watchcase instrument of Fig. 3, at 0.3 volt,

$$L = \frac{5.88}{R} \qquad \text{henrys} \quad (5)$$

The black dots on the inductance curves correspond, as before, to observations, and the small circles to values computed from (4) to (5).

OBSERVED RELATIONS BETWEEN DAMPED RESISTANCE AND DAMPED REACTANCE.

Multiplying the observed damped inductance L' by the angular velocity ω of the observation, we obtain the damped reactance $L'\omega$ plotted in Figs. 2 and 3 through the small crosses. It will be observed that, although the observed damped inductance diminishes with the frequency, the damped reactance increases with the frequency in essentially the same manner as the resistance, except in the neighborhood of zero frequency. In fact, with these receivers, the damped reactance is approximately equal to the damped resistance over a considerable range of frequency. This means that the damped impedance is approximately $\sqrt{2}\,R \angle 45°$ ohms over this range.

EFFECTS OF MOTION OF THE DIAPHRAGM UPON THE RESISTANCE AND REACTANCE.

In order to analyze the effects of motion of the diaphragm on the electrical properties of a receiver it is important to measure, at any given frequency and at constant terminal voltage, the resistance and inductance of the receiver, both damped and free.

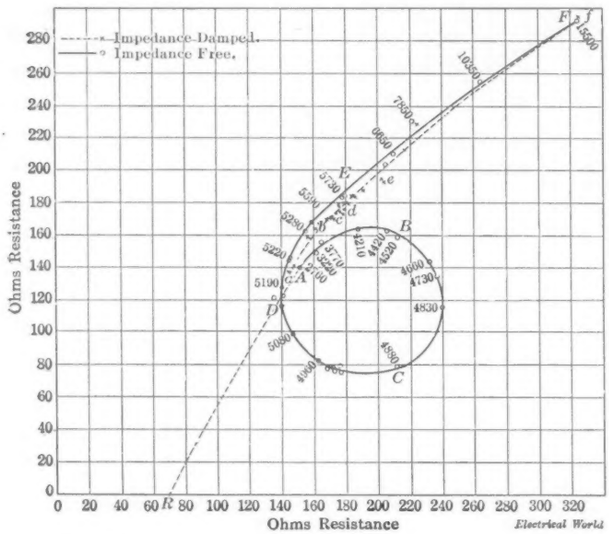


Fig. 4—Vector Impedance Diagram of Bipolar Bell Receiver, Damped and Free, at Different Frequencies.

Fig. 4 shows the locus of observed free and damped impedance in the case of the Bell bipolar receiver with 0.3 volt at terminals. Commencing at the angular velocity of $\omega = 2760$ radians per second ($f = 440 \sim$), the free impedance is $O\,A = 152$ ohms resistance, measured along the axis of abscissas, plus $j\,138$ ohms reactance, measured parallel to the axis of ordinates. At the same frequency the damped impedance was $O\,a = 146.3 + j\,135.1$ ohms. Below 440 cycles per second the impedance was not measured either free or damped; but the impedance locus may be assumed to follow the line of points $R\,A$, because at $\omega = 0$; or, with direct currents, the impedance was $O\,R = 71 + j\,0$ ohms.

As the angular frequency advances beyond 2760 radians per second the free impedance pursues the looped path $A\,B\,C\,D\,E\,F$, while the damped impedance pursues the smooth curve $a\,b\,c\,d\,e\,f$. Thus, at the angular frequency of 4880 radians per second, the free impedance is $O\,C = 212 + j\,78.1$ ohms, while the damped impedance is $O\,c = 173 + j\,171.4$ ohms. It will be observed, therefore, that there must be two widely different angular velocities (about 2000 and 5150 radians per second) at which the free impedance is identical and in the neighborhood of $O\,D$, although with the diaphragm damped the impedance would have changed from about $O\,D$ to $o\,d$, two values which would differ from each other by about 80 ohms.

Figs. 5 and 6 give the motional values of resistance, reactance and power for the Bell bipolar receiver with 0.3 and 0.42 volt at terminals respectively. If at any impressed angular frequency ω we denote the current strength, resistance and inductance by I', R' and L', with diaphragm free, also by I, R and L when damped, then the motional resistance is $(R' - R)$ ohms, the motional inductance $(L' - L)$ henries, the motional reactance $(L'\omega - L\omega)$ ohms, the motional impedance $(R' - R) + j\,(L' - L)\omega$ ohms, and the motional power $(I'^2R' - I^2R)$ watts. The values of I' and I were not directly observed but were computed from the constant terminal voltage and the observed impedance of the receiver. It will be observed that the motional resistance in Fig. 5 changes suddenly from $+ 68$ ohms, at 4830 radians per second, to $- 36.5$ ohms at 5050 radians per second. The motional reactance develops a sharp negative maximum near 5000 radians per second. The motional power is negative near 4000 radians per second, but rises to a sharp maximum of 180 microwatts near 5000 radians per second. Not all of this motional power is necessarily available for producing energy of vibrational motion in the diaphragm, but the power expended in moving the diaphragm and in producing sound is associated with this motional power. It would seem possible to measure the amount of power expended by the telephone diaphragm in sound through the use of an air pump to exhaust the air from a chamber containing the telephone, keeping all other conditions the same. The increase in motional power, at constant current strength, after admitting air into the chamber, should determine the power expended in sound. In the measurements here reported the electrical measurements were often distinctly, and sometimes markedly, affected by the absorption or reflection of sound waves from neighboring objects when the maximum sound and motional power were being developed. If an assistant walked across the room in front of the sounding telephone under test and at a distance of a meter or more from its face, the Rayleigh bridge balance was apt to be seriously upset. In the case represented by Fig. 6, of the Bell receiver with 0.42 volt at terminals, the motional power at resonance is 338 microwatts, an increase of 68 per cent over the damped power at the same frequency. That is, if the finger is removed from the diaphragm at this frequency, this telephone emits a loud sound and the power expended in the telephone jumps up 68 per cent.

CIRCULAR GRAPHS OF MOTIONAL IMPEDANCE.

If in Fig. 4, instead of plotting motional resistances and motional inductances as ordinates against angular frequencies as abscissas, we plot, from a selected point as origin, the vector motional impedance $a\,A$, $b\,B$, $c\,C$, etc.,

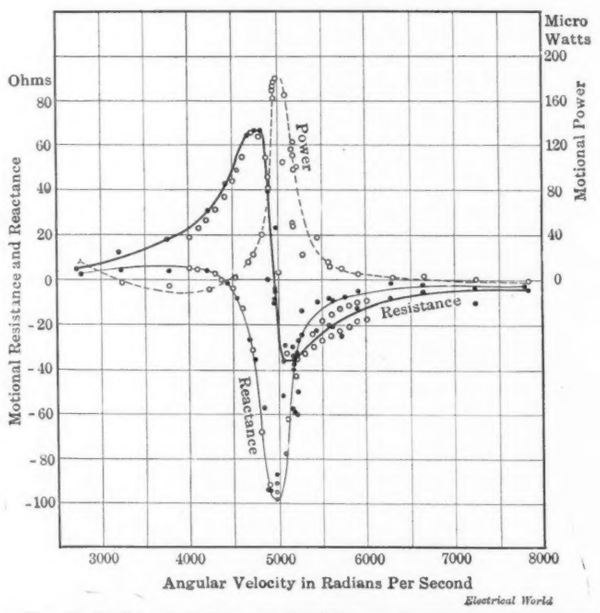


Fig. 5—Motional Values of Resistance, Reactance and Power for Bell Receiver with 0.3 Volt at Terminals and with Different Angular Velocities.

as in Fig. 7, we find that these vectors lie upon a circle, which may be called the circular graph of motional impedance. It will be seen that in Fig. 7 the motional impedance of the Bell telephone there represented is a pure resistance of 36 ohms near the angular frequency of 4300 radians per second, whereas it is a pure reactance of 95 ohms in the neighborhood of 4950 radians per second. At other frequencies it is a combination of resistance and

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reactance. The maximum motional impedance is the diameter of the circle and is 103 ohms, at an angle 70.5 deg. below the axis of resistance OR, and at the frequency 4885 radians per second, which is the resonant frequency of the receiver, or the fundamental frequency of its diaphragm. The small circles represent the observations, and the scale of numbers on the inside rim of the circle indicates computed values. It will be seen that the motional impedance on the graph commences at 0 for very low frequencies, reaches its maximum diametral value for the resonant frequency, and then diminishes again toward zero as the frequency is further increased.

In Fig. 8 the corresponding circular graph of motional impedance is presented for the same receiver as in Fig. 7, but with the terminal voltage raised to 0.42 volt. It does not differ materially from the graph of Fig. 7.

The circular graph for the watchcase receiver is given in Fig. 9. Here the diameter is depressed by an angle of 93 deg. below the axis of resistance.

In Fig. 10 are collected five circular graphs, all drawn to the same scale. The largest circle happens to belong to the experimental monopolar receiver and the smallest circle

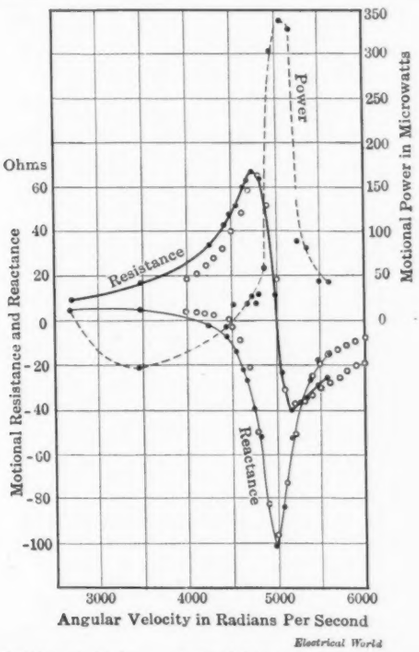

Fig. 6—Motional Values of Resistance, Reactance and Power for Bell Receiver R_V with 0.42 Volt at Terminals and with Different Angular Velocities.

to the experimental bipolar receiver, both employing the same diaphragm. It appears that the frequency of resonance is a property of the diaphragm only; as is also the spacing of the frequencies around the circle. On the other hand, the diameter of the circle, both as to magnitude and as to depression angle, depends upon the electromagnetic circuit of the receiver. The more powerful the inducing system the larger the diameter. The depression angle appears from the theory to be twice the angle of lag of magnetic flux behind electric current in the coils. This was found to be substantially true in the case of the experimental bipolar receiver, which was constructed with special exploring coils for investigating this point.

The circular graph of a receiver thus enables the natural frequency of the receiver diaphragm to be readily determined, and two distinct electrical methods are therefore available for the determination of this natural frequency.[3] Moreover, the theory of the subject indicates that the damping coefficient Δ of the diaphragm, or the log decrement per second of its free vibration, can also be obtained from the circular graph. In particular, if we find the frequencies ω_1 and ω_2, which correspond to the opposite ends of a diameter, perpendicular to the principle diameter of the graph, then Δ will be half the difference between ω_1 and ω_2. Thus, in Fig. 7, the angular velocities ω_1 and ω_2,

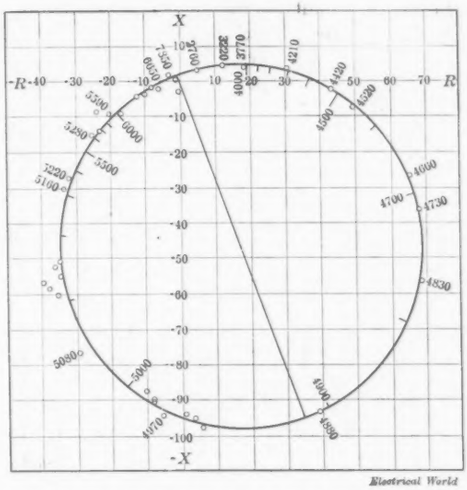

Fig. 7—Circular Graph for Bipolar Bell Receiver with 0.3 Volt at Terminals.

quadrantal to the principal diameter, are approximately 5100 and 4700 radians per second respectively, so that $\Delta = \frac{5100 - 4700}{2} = 200$ per second. This means that the diaphragm, if set in free vibration, would have its amplitude fall to $1/\varepsilon$, or to 0.3678, in a time equal to $1/\Delta$ seconds, or the two-hundredth part of one second. The further apart the quadrantal frequencies lie numerically, the larger is Δ and the greater the natural damping of the diaphragm's vibrations, or the sooner the amplitude of vibration will fall to $1/\varepsilon$ th.

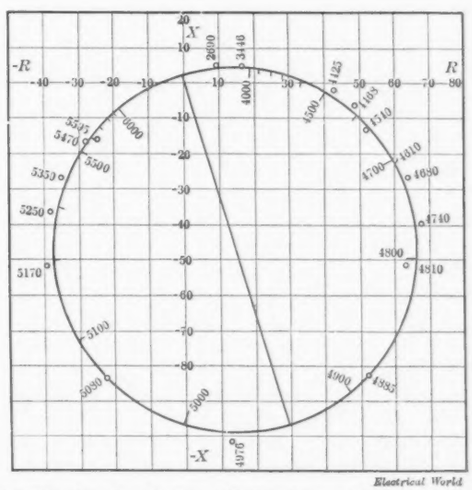

Fig. 8—Circular Graph for Bell Receiver with 0.42 Volt at Terminals. Diameter 103.5 Ohms. Depression Angle $2B = 73°$ $W_0 = 4940$ Radians per Second.

THEORY OF THE CIRCULAR GRAPH OF MOTIONAL IMPEDANCE.

As a first approximation to the theory, we shall assume that, so far as concerns the fundamental frequency of the diaphragm, the elastic restoring force of the diaphragm is concentrated at the center and is proportional to the displacement; that the actually distributed mass of the diaphragm may be replaced by an equivalent mass concentrated at the center, and that the motion is opposed by

[3] It has been shown in a paper by Messrs. A. E. Kennelly and W. L. Upson on "The Humming Telephone," *Proceedings* Am. Phil. Soc., 1908, that the natural period of vibration of a telephone may also be obtained from humming telephone measurements.

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a frictional force proportional to the velocity and also concentrated at the center. Then, if the diaphragm is solicited by a sinusoidal force of maximum cyclic value F (Fig. 11),

$$sx + rx' + mx'' = f = F\varepsilon^{j\omega t} \quad \text{dynes} \angle \quad (6)$$

where

x = the displacement of the effective mass of the diaphragm from its position of rest (cm).
x' = the displacement velocity (cm/sec).
x'' = the displacement acceleration (cm/sec^2).
s = the elastic force per unit displacement (dynes/cm).
r = the resisting force per unit of velocity (dynes per cm per second).
$f = F\varepsilon^{j\omega t}$, the impressed moving force measured in the direction of x toward the poles (dynes).
$\omega = 2\pi n$, the angular velocity of the impressed force (radians per second).
n = the frequency of the impressed sinusoidal force (cycles per second).
$j = \sqrt{-1}$.

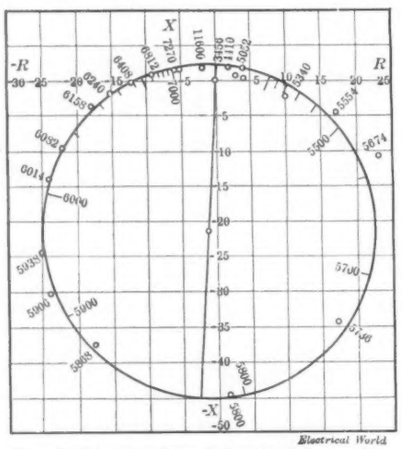


Fig. 9—Circular Graph for Watchcase Receiver. Diameter 47 Ohms. 0.3 Volt at Terminals.

Depression Angle B = 93°. W_o = 5820 Radians per Second. Δ = 150.

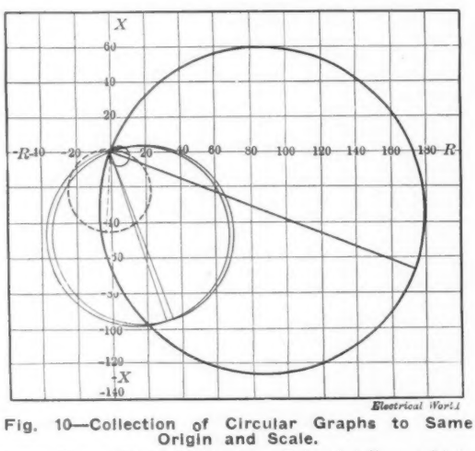


Fig. 10—Collection of Circular Graphs to Same Origin and Scale.

Large Heavy Circle, Monopolar. Pair of Adjacent Light Circles, Bell Bipolar with 0.3 and 0.42 Terminal Volt Respectively. Broken Line, Watchcase Receiver. Small Black Circle, Experimental Bipolar Receiver.

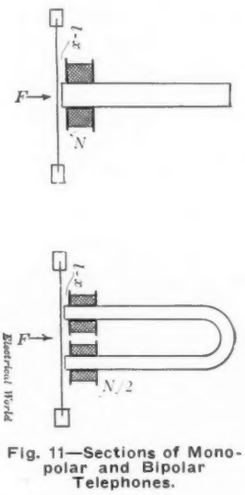


Fig. 11—Sections of Monopolar and Bipolar Telephones.

The solution of equation (6) for velocity of displacement is well known and may be written in the form

$$x' = \frac{f}{r + j\left(m\omega - \frac{s}{\omega}\right)} = \frac{f}{z} = \frac{F\varepsilon^{j\omega t}}{z} \quad \text{cm/sec} \angle \quad (7)$$

where

$$z = r + j\left(m\omega - \frac{s}{\omega}\right) \quad \text{dyne sec/cm} \angle \quad (8)$$

This solution corresponds precisely to the well-known case of a sinusoidal emf impressed upon a simple series circuit of resistance, inductance and capacity. The mechanical displacement x corresponds to electric quantity, the displacement velocity x' to electric current, the velocity opposing resistance r to the current opposing resistance, the mass m to the inductance, and the mechanical elastance s to the electric elastance, or reciprocal of capacity. The quantity $m\omega$ may therefore be called the mechanical inertia reactance, the quantity s/ω the mechanical elastic reactance, and z the mechanical vector impedance. Consequently, just as in the electric circuit considered, it can be shown that the graph of the electric current is a circle, as the frequency varies from 0 to infinity, so the displacement velocity graph is also a circle. The diameter of the circle will coincide with the axis of reals, and will be equal to F/r cm/sec for the frequency of resonance; i. e., that frequency at which the inertia reactance $m\omega$ is equal and opposite to the elastic reactance s/ω or when the total reactance vanishes. The phase of the velocity will then concur with that of the impressed force. For sub-resonant frequencies the phase of the velocity will lead, and for super-resonant frequencies the phase of the velocity will follow that of the impressed force.

The mechanical force f, above considered, is produced by the magnetic flux across the air-gap or gaps of the receiver. If φ is the mean flux through the active part of the magnetic circuit, we have in a bipolar receiver:

$$\varphi = \frac{F}{R} = \frac{F_o + 4\pi Ni}{R_o + \frac{2(l-x)}{S}} = BS \quad \text{maxwells} \quad (9)$$

and in a monopolar receiver:

$$\varphi = \frac{F}{R} = \frac{F_o + 4\pi Ni}{R_o + \frac{l-x}{S}} \quad \text{maxwells} \quad (10)$$

where

F = the total mmf due to the permanent magnet and to the current in the coils (gilberts).
F_o = the mmf due to the permanent magnet alone (gilberts).
R = the total reluctance of the magnetic circuit (oersteds).
R_o = the reluctance of the circuit exclusive of the air gaps (oersteds).
N = the total number of turns in the receiver coil or coils.
$i = I\varepsilon^{j\omega t}$, the instantaneous current in the coils (absamperes).
l = normal air-gap between poles and diaphragm (cm).
B = mean flux density in the air-gap (gausses).
S = area of one gap (cm^2).

Then

$$f = 2S\frac{B^2}{8\pi} = \frac{\varphi^2}{4\pi S} \text{ for a bipolar receiver} \quad \text{dynes} \quad (11)$$

and

$$= S\frac{B^2}{8\pi} = \frac{\varphi^2}{8\pi S} \text{ for a monopolar receiver} \quad \text{dynes} \quad (12)$$

If we denote by f_i the relatively small part of the total force which is due to the current i, we may write:

$$f_i = \frac{df}{di}\, i \quad \text{dynes} \angle \quad (13)$$

which, by substituting from (11) and (9), becomes:

$$f_i = \frac{2\varphi}{4\pi S} \cdot \frac{d\varphi}{di} \cdot i$$

$$= \frac{2N\varphi}{RS} i = \frac{2NB_o}{R} i \text{ for a bipolar receiver} \quad \text{dynes} \angle \quad (14)$$

and

$$f_i = \frac{NB_o}{R} i \quad \text{for a monopolar receiver} \quad \text{dynes} \angle \quad (15)$$

In order to avoid maintaining parallel discussions for bipolar and monopolar receivers, it will suffice to write:

$A = \frac{2 N B_o}{R}$ for a bipolar receiver dynes/absamperes (16)

and

$A = \frac{N B_o}{R}$ for a monopolar receiver dynes/absamperes (17)

In either case then $f_i = A i$ dynes $\angle$ (18)

on the assumption that the pull on the diaphragm is in phase with the flux, and that the flux is in phase with i. But owing to the effects of hysteresis, as modified by eddy currents, the flux and the pull will lag behind i by a certain angle β_1; so that (18) becomes

$$f_i = A i \angle \beta_1 \quad \text{dynes} \angle \quad (19)$$

Consequently by (7) $x' = \frac{A i \angle \beta_1}{z}$ cm/sec $\angle$ (20)

The emf induced in the coils by the motion of the diaphragms will be, in the absence of hysteresis,

$$e_x = N \frac{d\varphi}{dt} = N \frac{d\varphi}{dx} x' \quad \text{abvolts} \angle \quad (21)$$

and by differentiating (9) or (10), this becomes

$$e_x = \frac{2 N B_o x'}{R} = A x' \quad \text{abvolts} \quad (22)$$

and substituting from (20)

$$e_x = \frac{A^2 i \angle \beta_1}{z} \quad \text{abvolts} \quad (23)$$

But there will also be a hysteretic lag of flux with respect to change of air-gap length, and this will cause the induced emf to lag by a certain angle β_2. Consequently, (23) becomes:

$$e_x = \frac{A^2 i \angle \beta_1 + \beta_2}{z} \quad \text{abvolts} \angle \quad (24)$$

If L and R'' are the inductance and resistance of the receiver when damped, in abhenries and absohms respectively, the damped impedance of the receiver will be:

$$Z = R'' + j L \omega \quad \text{absohms} \angle \quad (25)$$

If e is the instantaneous value of the impressed sinusoidal emf of the type $E\varepsilon^{j\omega t}$ abvolts, we have,

$$e = i Z \quad \text{abvolts} \angle \quad (26)$$

But, owing to the influence of the emf of motion, the last equation becomes, when the diaphragm is free:

$$e = e_x + i Z \quad \text{abvolts} \angle \quad (27)$$

That is, by (23),

$$e = i \left\{ Z + \frac{A^2}{z} \angle \beta_1 + \beta_2 \right\} = i Z' \quad \text{abvolts} \angle \quad (28)$$

where Z' is the free impedance of the receiver, in absohms.

This means that the impedance of the receiver has become increased, through the motion of the diaphragm, by a motional impedance:

$$Z' - Z = \frac{A^2}{z} \angle \beta_1 + \beta_2 \quad \text{absohms} \angle \quad (29)$$

This motional impedance, being the reciprocal of z, a straight line locus, when ω is variable, is a circle for variable ω, with a diameter A^2/r absohms, depressed below the axis of reals by an angle $\angle \beta_1 + \beta_2$. It seems reasonable that whether the flux lags behind a cyclic magnetizing current or behind a cyclic air-gap reluctance, the angle of lag should be the same; or that $\beta_2 = \beta_1 = \beta$ say. This equality was substantially borne out in the experimental case. Consequently, we may write (29)

$$Z' - Z = \frac{A^2}{z} \angle 2\beta \quad \text{absohms} \quad (30)$$

Therefore, if we vary ω from 0 to ∞, keeping the impressed emf and all other quantities constant, the motional impedance has a circular graph through the origin, with its principal diameter of length A^2/r, depressed 2β below the axis of reals.

In the particular case when the angular velocity ω_o is such that the inertia reactance $m\omega$ is equal to the elastic reactance s/ω_o—that is, when

$$\omega_o = \sqrt{s/m} \quad \text{rad/sec} \quad (31)$$

the mechanical impedance z becomes by (8) equal to the mechanical resistance r, and (30) becomes, for the resonant condition:

$$Z' - Z = \frac{A^2}{r} \angle 2\beta \quad \text{absohms} \quad (32)$$

the principal diameter of the circular graph.

Again, let Δ be the logarithmic decrement per second of the diaphragm, if vibrating in the absence of impressed forces; then, by the theory of elasticity:

$$\Delta = \frac{r}{2m} \quad \text{numeric/sec} \quad (33)$$

and if α is the angle of the mechanical impedance z in (8),

$$\tan \alpha = \frac{m\omega - \frac{s}{\omega}}{r} \quad \text{numeric} \quad (34)$$

From (33) and (34)

$$\omega \tan \alpha = \frac{\omega^2 - \omega_o^2}{2\Delta} \quad \text{numeric/sec} \quad (35)$$

An equation from which the angular position in the circular graph can be found for each value of ω, knowing ω_o and Δ; or, having found ω_o from the graph and at one other frequency ω, the point corresponding thereto on the graph, with its vector making an angle α with the diameter, we may use (35) to find Δ. In particular, if we choose a quadrantal point on the graph at which ω is ω_1 say, so that $\alpha = 45$ deg. and $\tan \alpha = 1$, we obtain:

$$\Delta = \frac{\omega_1^2 - \omega_o^2}{2\omega_1} \quad \text{numeric/sec} \quad (36)$$

Or, if we select the two quadrantal points which lie respectively 45 deg. below and above the principal diameter, and for which $\tan \alpha$ is respectively $+1$ and -1, we obtain from (35)

$$\Delta = \frac{\omega_1 - \omega_2}{2} \quad \text{numeric/sec} \quad (37)$$

The measurements described in this paper thus enable ω_o and Δ to be determined for a telephone receiver, but do not permit of determining the fundamental constants r, m and s. Nevertheless, it would seem that if, after taking such a series of measurements on a receiver, a small load of known mass were secured to the center of the diaphragm and the series repeated, the two series should enable these fundamental constants to be evaluated between them.

SUMMARY OF RESULTS AND CONCLUSIONS.

(1) The resistance and inductance of several telephone receivers were measured over a wide range of frequencies, with their diaphragms both free and damped.

(2) In two typical forms of receiver the damped resistance was found to be a quadratic function of the frequency.

(3) Although the damped resistance and the damped inductance both vary with the frequency, their product was found to be a constant, independent of the frequency, over a considerable portion of the range of audible frequencies.

(4) The free resistance and reactance of a receiver go through marked changes with changes of impressed frequency in the neighborhood of the natural fundamental frequency of its diaphragm.

(5) The motional resistance and motional reactance—that is, the excess of free over damped resistance or reactance—conform accurately to certain simple laws, thus:

I. The motional reactances plotted as ordinates against the motional resistances as abscissas as the frequency of constant impressed emf is changed from zero to infinity give a circular locus, with various interesting characteristics, for which a first approximation theory is given.

II. The rectangular plots of motional reactance and motional resistance, against angular velocity of constant impressed emf, give curves somewhat analogous to the curves of index of refraction and absorption of light in an optical medium, in the neighborhood of an absorption band.

(6) The power taken by a telephone receiver when sounding at 0.3 volt applied voltage may exceed by 68 per cent the power taken from the same emf when the diaphragm is damped.

GUIDE AND GRIPPER

Central Station
Management, Policies and Commercial Methods

RULES FOR EMPLOYEES' SAFETY.

The Minneapolis General Electric Company has recently issued to its employees a carefully prepared booklet of safety rules, including copies of the state labor laws and suggestions by the state commissioner of labor. Each book is numbered and the recipient is held responsible for its safekeeping as well as for familiarity with its provisions. The first page is a perforated leaf carrying a blank statement that the employee has read and thoroughly understands the rules therein set down. Within ten days after receiving his copy the employee must sign and return this sheet to the company's office. Besides the general operating rules, there are instructions for the use of special safety devices, descriptions of methods of resuscitation from electric shock, etc. The publication of this book of rules is but one of a number of measures to conserve employees' safety recently carried out in Minneapolis. By a recent city ordinance there all poles carrying 2300 volts or more must be marked with a 3-in. ring of bright red paint just below the lowest cross-arm. Each ring must be kept bright.

COST OF EXTENDING A SMALL CENTRAL STATION.

The following figures, prepared by the Amesbury (Mass.) Electric Light Company, give the estimated cost of a 500-kw extension of the present generating plant, including further a small amount of new line work to provide for additional street lighting. The plant now includes two direct-connected engine generating sets of 200-kw and 375-kw rating. The ordinary day load of the plant is 400 kw and the winter peak load 530 kw. The additional capacity is required as a reserve.

SUMMARY OF ESTIMATE.

Power Station.	
One 500-kw. two-phase, 2300-volt, 60-cycle turbo-generator; f.o.b. works	$9,000
One No. 5 Le Blanc condenser, with air and circulating pumps, driven by 25-hp steam turbine, erected	2,350
Foundations.—Concrete, 8 ft. x 16 ft. x 8 ft. 6 in., for condenser and turbine	800
Wiring.—3-in. iron conduit and fittings from switchboard to generator, with four No. 0 conductors in cable and two No. 4 wires for exciter	250
Instruments.—Two series transformers, one recording wattmeter, one indicating wattmeter, and scales changed on two ammeters	135
Piping.—Extension of 8-in. steam main 14 ft.; 5-in. pipe in basement for turbine and condenser; 10-in. overflow pipe to river adjoining station; tile for steam piping; 10-in. atmospheric exhaust	600
Freight, cartage and erection	125
Plans for foundation, piping, etc	50
Sundries	100
Total, power plant	$13,410
No boiler expense required.	
Line Extensions.	
Poles.—46 30-ft. chestnut poles, including teaming, shaving, setting and painting	$322
Cross-arms and braces	40
Guying, including labor and material	160
Wire.—10,360 ft., No. 6 weatherproof wire	216
Trimming trees	75
Street Fixtures.—21 brackets, sockets, 40-watt lamps, etc	103
Labor	375
Total line extensions	$1,291
Grand total	14,701

The estimated cost per kilowatt for power plant extensions amounts to $26.80, while the cost of line extensions is about $1,300 per mile.

LIGHTING PLANT IN "FARTHEST NORTH."

What is probably the most northerly electric lighting plant on the eastern side of the North American continent is a small installation at St. Anthony, Newfoundland, about 50 miles south of the celebrated Straits of Belle Isle, separating Newfoundland and Labrador. The plant has a rating of only 11 kw and consists of a 230-volt continuous-current generator driven by an 18-hp kerosene engine which is operated on crude petroleum, the fuel consumption being about 2¼ gal. per hour, with an average load of 30 amp. The installation supplies energy for lighting the buildings and grounds of the Royal National Mission to Deep-Sea Fishermen, of which the well-known Dr. Wilfrid T. Grenfell is the head. The buildings lighted are the hospital, orphanage, guest house, director's residence, several tenements and smaller structures, about 400 incandescent lamps being in service. The inside lighting includes 275 16-cp lamps, 125 8-cp units and several 32-cp lamps, the operating room of the hospital being well equipped with the latter. About a dozen 16-cp lamps are in service on the paths connecting the different buildings and a red pilot light is used at the end of the mission pier to facilitate the docking of vessels. Tungsten lamps are being installed in place of carbon units, and about 2 miles of outdoor wiring are in service. A Wappler X-ray machine is being installed in the hospital. The plant is operated from a minimum of three hours per day (8 to 11 p. m.) in summer to eleven hours per day in winter (4 to 11 p. m. and 4 to 8 a. m.), the winter nights being long in this high latitude and correspondingly short in summer. An employee of the mission is in charge, and the equipment was the gift of the trustees of Pratt Institute, Brooklyn, N. Y.

PRESENT-DAY TENDENCY TOWARD CONSOLIDATION IN THE ELECTRIC-SERVICE INDUSTRY.

One of the most important and significant features of the electric-service industry in the United States at the present time is the tendency toward the absorption of small, or comparatively small, central-station properties into large combinations. Mr. John F. Gilchrist of Chicago, former president of the National Electric Light Association, alluded to this tendency in general terms in an interesting address which he made before the Commonwealth Edison Company Section of the N. E. L. A. on Sept. 5. Speaking of the outlook in the central-station field, he said that the present situation might be compared to that in the railroad industry fifty or sixty years ago. At that time a man traveling from New York to Chicago found it necessary to use six connecting railroads with frequent changes of cars and much inconvenience. But this has all been done away with, and now great trunk-line railroads, each under its own management for the whole distance, extend from Chicago to New York and from Chicago to the Pacific Coast. This change has greatly enhanced the convenience and comfort of the traveling public.

It may be supposed that the central-station business is undergoing something like the same change that has been witnessed in railroading. For a long time operating syndicates have existed, but these older controlling companies are operating central stations scattered all over the country. There is now a pronounced tendency to include, say, an entire state or a great part of an entire state in one single operating system or in several systems working together. The work of Mr. Samuel Insull and his associ-

ates in the State of Illinois is an indication of this tendency.

Mr. Gilchrist sketched the development of the Public Service Company of Northern Illinois, operating in the northeastern part of the State; the Illinois Northern Utilities Company, operating in the northwest part of the State, and the Central Illinois Public Service Company, operating in the central portion of the State. All of these are "Insull companies" and work in harmony. The Central Illinois company is one of the most recent, and it has already secured properties in perhaps thirty or forty towns, although not taking over the central stations in all the cities and villages in the territory served. The operations of these large companies indicate the existence of a movement that may lead to the covering of an entire state by one system or by several large co-operating systems. This plan of combination allows the location of generating stations at the most advantageous points, and Mr. Gilchrist mentioned the new station which is to be built at Kincaid, in Christian County, in the central part of Illinois, where it will be practically at the mouth of a coal mine, so there will be almost no expense for transporting coal. This station will have a rating of from 10,000 kw to 15,000 kw, and its size may be increased later.

California is another State where the same tendency toward concentration is evident. The Pacific Gas & Electric Company of San Francisco operates over perhaps one-third of the area of the State. Much of its energy is derived from water-power, but it has also a number of steam generating stations. Gas is piped for considerable distances under high pressure in much the same way that electricity is transmitted at high voltages. Both gas and electricity are used for a wide variety of industrial operations.

The speaker expressed his belief that it will be only a few years before electric-service systems will be combined in much the same way as the railroad systems have been combined and will cover large areas. This tendency is of great significance and interest to all engaged in the business because it gives an indication of the opportunities which the electric-service industry offers to young men.

PRIZE-WINNING SUGGESTIONS FOR IMPROVEMENTS IN CENTRAL-STATION SERVICE.

Like a number of other companies, the Commonwealth Edison Company of Chicago offers prizes for accepted meritorious suggestions in relation to possible improvements in the company's business. Awards were recently made of these prizes for the semi-annual period ended June 30, 1912. The list which follows is of general interest as indicating the character of suggestions, some of them apparently quite simple, which were accepted:

First Prize, $50.—Awarded to Mr. R. E. Sweetland, who recommended that the painters at the Fisk Street station be provided with safety belts.

Second Prize, $40.—Awarded to Mr. E. D. McEwing, who recommended an improved method of handling complaints that are referred to the distribution engineering department, with the idea of obtaining greater efficiency and dispatch.

Third Prize, $30.—Awarded to Mr. H. G. Kobick, who suggested that all recommendations, instructions, executive orders and circular letters from the executive office of the company be compiled, codified and arranged in some form similar to the company's classification of accounts for the convenience of heads of departments.

Fourth Prize, $20.—Awarded to Mr. W. H. Childs, who proposed a scheme for promoting the sale of electric appliances to small stores and tradesmen by getting out descriptive literature, with the plan of having employees of the company bring such literature personally to the attention of the tradesmen with whom they deal.

The prize of $10 for the greatest number of suggestions accepted from any one employee during the six-month period was divided. One-half was awarded to Mr. A. G. Chamberlain and one-half to Mr. Charles Davidson, both of whom had four accepted suggestions to their credit during the semi-annual period.

TEST FOR POWER REQUIREMENTS OF A PAPER MILL.

BY W. E. BYERTS.

The following test to determine the power required by various machines was run in a paper mill which takes old newspapers and makes a paper out of them which in turn is made into pasteboard suitable for boxes, etc.

The plant is equipped with direct-current motors, so it was only necessary to connect an ammeter in series with the motor being tested and read the current and the voltage to obtain the power input. The horse-power output was calculated from the input by assuming an efficiency of 90 per cent in the heavily loaded motors and 85 per cent in those lightly loaded, which will give fairly accurate results. The machines contained in the plant are as follows, the accompanying table showing the amperage, voltage and output for each:

Paper Machine.—The paper machine is driven by a 90-hp motor with a speed of from 200 r.p.m. to 800 r.p.m., which is obtained by field control. This machine has sixty-two drier rolls 32 in. in diameter by 110 in. long.

Pumps and Screens on Paper Machine.—These are driven by a 90-hp motor running at 525 r.p.m. The load on this motor is practically constant for all grades of paper.

Jones Standard Jordan.—Directly connected to a 75-hp motor running at 345 r.p.m. This motor was bought under a continuous overload guarantee and is really about a 100-hp machine.

Jones Imperial Jordan.—Directly connected to a 100-hp motor running at 330 r.p.m. This motor was also bought on a continuous overload guarantee.

Beaters.—A 100-hp motor is belted to two beaters, the motor running at 450 r.p.m. The beaters have a capacity of 1500 lb.

The reading marked "average" on the test on the standard Jordan was taken when it was on a medium fine paper and is actually a little above the average. The "maximum" on the tests on both the Jordans was taken when they were on the finest grade of paper this mill makes. The reading marked "full pulp, rolls up," on the beaters is the condition under which they operate most of the time. The reading with "both rolls brushing" is a little higher than the average for this condition.

TEST OF POWER REQUIRED BY PAPER-MILL MACHINERY.

	Amperes.	Volts.	Output, hp.
Paper machine:			
High speed, light paper	264	226	68
Low speed, heavy paper	138	211	33
Pumps and screen on paper machine	150	227	38.7
Jones standard Jordan:			
Running light	63	220	16
Average load	450	214	115
Maximum load	484	218	126
Jones imperial Jordan:			
Running light	204	220	54
Average load	474	224	127
Maximum load	570	221	151
Heater:			
Full pulp, rolls up	306	225	69
Full pulp with both rolls brushing	570	218	149

Wiring and Illumination

ILLUMINATION OF PLAYGROUND WITH INVERTED MAGNETITE LAMPS.

Holstein Park, a new playground near Oakley and Hamburg Streets, Chicago, recently equipped by the West Side Park Commissioners at an outlay of $75,000, is lighted by

Fig. 1—Ornamental Magnetite Standards, Holstein Park, Chicago.

ten 6.6-amp inverted magnetite lamps mounted on ornamental iron standards, of the collective type which has come to be best known as the "Hartford post." The park or playground measures 200 ft. by 400 ft. and is given over to apparatus for children's games, turntables, swings, see-saws, etc. As the result of its location in a populous region, it draws its patronage from within a radius of a mile or more. At one end of the grounds is a splendid social-center building, containing an auditorium, library, gymnasium, showers and locker rooms.

The lamps are of the General Electric "inverted" type, having their mechanism concealed in the standard below

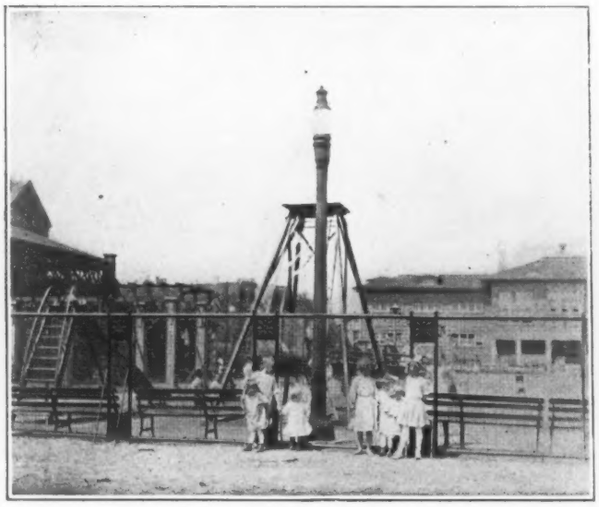


Fig. 2—Playground Lighting with Inverted Magnetite Lamps.

the arc, and are carried on handsome 15-ft. iron posts. Four lamps are ranged along the sides and two at the ends of the grounds, at intervals of approximately 75 ft. between posts. The rectifier equipment for the 6.6-amp circuit is installed in the basement of the settlement building. Each lamp consumes approximately 500 watts. The playground is open until 10 o'clock every evening and is the social focus of many of the older folk of the neighborhood as well as the young people. Adequate illumination after dark was therefore important to secure the full value of the park to the class it is intended to serve. After a study of available lighting units the lamps here shown were selected. As the units are arranged, ample illumination is provided over the entire area, and some of the more enthusiastic handball players of the neighborhood have even continued their games after nightfall. Mr. Frank Ksander is chief electrician for the West Side Park Board.

REMOTE-CONTROL ORNAMENTAL LIGHTING.

The business section of Billings, Mont., is lighted by 190 ornamental curb posts, each carrying four 40-watt and one 100-watt lamp, fed through seven separate distributing

Fig. 1—Twenty-eighth Street, Billings, Mont.

centers. A negro was formerly employed at $20 a month to turn these circuits on and off, but his irresponsibility led to the installation of a system of pilot wires and magnet switches centering at the central-station office. From this point all the lamps can now be turned on before the employees leave for the night. The master switch of the control wiring is itself held in place by a magnetic telephone drop which is bridged across the private line connecting the

Fig. 2—Night View of Twenty-seventh Street, Billings, Mont.

office and power plant. To extinguish the street lamps at dawn the switchboard operator thus has only to ring up the office line, throwing the drop which releases the master switch and allows the latter to open the distant magnet switches. The cost of installing the remote-control system complete was $125, which was saved in about six months.

FLAME-ARC LAMPS FOR PARK LIGHTING.

The Board of Commissioners of the South Side Parks, Chicago, has purchased 280 7.5-amp flame-arc lamps which it is using to replace the former inclosed carbon lamps at

Fig. 1—Flame-Arc Lamps, Jackson Park, Chicago.

important boulevard and drive intersections. The new units are arranged for insertion in the existing alternating-current series circuits, and consume from 300 watts to 400 watts per lamp. In design they are similar to the flame lamps purchased for the city street lighting of Chicago and were also furnished by the General Electric Company. In the South Park system there are altogether twenty-four parks and playgrounds, besides 50 miles of boulevards. For the illumination of these parks and drives about 15,000 arc lamps are needed, of which number nearly 12,000 are in use at the present time.

A number of the new flame lamps have been employed for the lighting of Michigan Avenue south from Twelfth Street, the end of the lake-front ornamental curb lighting. The lighting of these boulevards falls within the scope of the park board's responsibilities and is not part of the general street lighting of the city. On Michigan Avenue near Eighteenth Street a number of the new lamps have

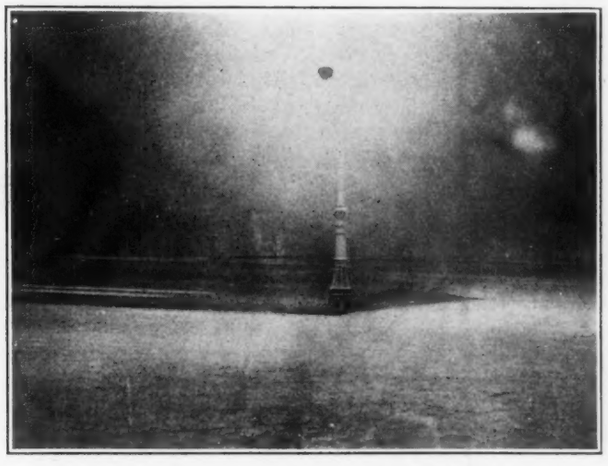


Fig. 2—7.5-Amp Flame-Arc Lamp in Jackson Park, Chicago.

been suspended from 25-ft. poles, as an experiment in the determination of the proper height of these units. At this height the lamps are well above the angle of glare for ordinary vision, at the same time affording uniform illumination over a larger area of the street.

The installation of the new lamps at important dark corners in the parks has contributed to the safety of both pedestrians and automobilists. With the flame type of units the whole area of broad drive intersections is well lighted, so that no driver now has excuse for turf cutting or crossing island "greens," which had become too frequent with the older inclosed-arc lamps. Mr. W. R. Bell is electrical engineer for the South Park Commission.

INDIRECT LIGHTING IN A "SODA DEN."

Indirect lighting is utilized effectively in the so-called "soda den" of one of the Liggett drug stores in Boston, twelve fixtures being used, as shown in the accompanying illustration. The den occupies a portion of the basement at 474 Washington Street, and is cleverly advertised on the main floor of the establishment by illuminated signs, including an Old English lantern equipped wtih incandescent lamps. The den is 56 ft. long by 39 ft. wide at its broadest portion, the average width being about 30 ft. The architectural treatment of the room is Old English, the walls being of paneled mahogany with wainscoting in light green decorated by mural paintings of sixteenth century scenes. Nine columns of mahogany-colored tiling

Indirect Lighting in a Refreshment Room.

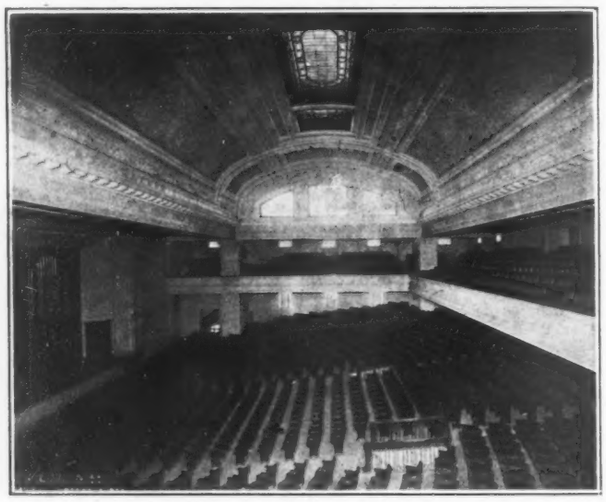
with green upper sections support the street floor, and the floor of the den is of rubber tiling with red, brown, blue and white shades interlocking, the red being the dominating color. Three rows of tables with mahogany tops 30 in. above the floor and 36 in. square occupy the center of the floor, and at the west end are located an artificial fountain with electrically pumped water and a 6-ft. by 12-ft. marble-topped soda fountain with a counter 16 in. wide by 42 in. high. The latter is illuminated with two old-fashioned ornamental lanterns, each equipped with a 50-watt frosted metallized-filament lamp.

The indirect lighting fixtures, which are provided with opaque bottoms, are each 22 in. in diameter and are hung 9 ft. 8 in. above the floor and 29 in. below the ceiling, which is painted white, with a dull finish. Each fixture for the main lighting of the room contains four 60-watt tungsten lamps. Twenty-four tables are in service, and there is no side lighting whatever. No candelabra are used on the tables, and even at the sides of the room under the ventilators fine print can be read with ease by means of the general illumination. The wiring is arranged for the control of each pair of fixtures by a single strap switch mounted in a wall panel just outside the room. An equipment of eight 10-in. electric fans and a motor-driven egg-beater is also provided. About 1.8 watts per sq. ft. are required by the room.

INDIRECT LIGHTING OF AN ARCHED AUDITORIUM CEILING.

In laying out the illumination of the fine new temple and social center of the Sinai Jewish Congregation at Grand Boulevard and Forty-sixth Street, Chicago, care was taken to permit no direct glare from lamp filaments to annoy the eye. In the auditorium and assembly room pure indirect illumination has been used, while the guest parlors in the social-center building are lighted by semi-indirect fixtures.

The main auditorium, shown in the illustration, measures 137 ft. wide by 100 ft. deep and is surmounted by a vaulted ceiling. The arch of the ceiling has a spring of 50 ft. and a rise of 16 ft., its border cornices being at an average height of 35 ft. above the inclined floor. Concealed within the plaster work of these cornices are rows of tungsten reflector units, light from which is projected onto the light-tinted arched ceiling and from that as a diffusing surface down to light the chair space. There are forty-eight reflector units on each of the front and rear cornices, each poke-bonnet reflector containing a 60-watt lamp. These lamps are arranged in three circuits, controlled from Diamond "H" remote-control electromagnetic switches, which are actuated from push-buttons in the anteroom at the right of



Indirect Illumination of Sinai Temple Auditorium, Chicago.

the organ. The magnet switches themselves are mounted in a metal box in the room at the left of the rostrum.

Originally the plan was to have several control stations for the auditorium lighting, one being in the choir gallery at the side of the proscenium, so that the illumination could be switched on and off by the organist or the director of the services. The single-control station actually installed makes possible, of course, the replacement of knife switches by a bank of simple flush push-buttons, but introduces some complications into the lighting circuits.

Surrounding the proscenium over the rostrum is a row of 60-watt lamps in border type reflectors, designed to illuminate the platform, organ and speaker. For lighting the portions of the main floor beneath the balcony, as well as the balcony sections which are outside the main arched ceiling, there are fifteen ceiling clusters for each floor, each comprising four 40-watt lamps inclosed in diffusing half-domes. These ceiling clusters are, however, outside of the visual angle of most of the occupants of the chairs beneath the overhanging balconies. Ceiling and walls of auditorium interior are all white with tinted panel patterns, but the chairs are of dark wood and the floor is carpeted in a rich brown.

For the corridors direct-type fixtures have been used. The assembly room in the adjoining social-center building is decorated in pure white and has a waxed hardwood floor suitable for dancing. Its ceiling is paneled into nine divisions by the beaming, the center of each section being marked by an indirect bowl fixture containing four 40-watt lamps. The bowls are handsomely ornamented with gold leaf and are suspended from the ceiling by bronze chains. Around the walls of the room are eight groups of bracket lamps partially concealed by glass prisms. In the ladies' and gentlemen's reception rooms semi-indirect fixtures with alabaster bowls are employed, the light which finds its way through the diffusing glass brightening the otherwise dark bottom of the fixture.

Mr. A. S. Alschuler was the architect for the new Sinai Temple and social center. The electrical equipment was laid out by Mr. M. C. Schwab, consulting engineer. Electrical wiring was done by Mr. O. M. George.

RECENT TELEPHONE PATENTS.

DISPATCHING APPARATUS.

Mr. E. R. Gill, of Yonkers, N. Y., has invented a clock synchronizing system for use in conjunction with a telephone railway dispatch wire. The system contemplates the introduction upon the dispatch wire of time signals. This will occur at specified hours and all blocks may be set to exactly the same time. The system contemplates either direct application of the time signals to the telephone line or the connection of a telegraph line carrying time signals to the telephone line in such a manner that the signals are impressed upon the telephone line.

Another patent granted to the same inventor describes a sender for a step-by-step system. The sending process is accomplished by first instituting a rapid series of impulses, a device for interrupting or arresting these at the proper interval and a device for freeing or restoring the series of impulses. The intervals are spaced by predetermined action so that the desired number is transmitted.

Letter to the Editors

INCREASING RANGE OF VOLTAGE REGULATION.

To the Editors of the Electrical World:

Sirs:—On page 293 of your issue dated Aug. 10 there is an editorial in which reference is made to my article in the issue dated July 27, entitled "Increasing the Range of Shunt-Voltage Regulation in Direct-Current Generators." This editorial terminates with the following sentence: "We believe, however, that a similar pole-face construction of projecting laminas has been used in the past for the purpose of improving commutation." It is, in fact, well known to me that somewhat similar constructions were employed for improving the commutation at a time when the auxiliary pole was not yet in use for this purpose. In that case, however, as you rightly assume, another object was desired, namely, to lessen as much as possible the influence of the armature reaction on the pole field, especially in the commutation zone.

In the case of the construction described by me the laminas, which project over the whole of the pole face, are in a definite ratio to the latter. In the middle, taken together, they have a section of from one-tenth to one-twelfth of that of the total pole face, and therefore in this instance an endeavor has been made to obtain a special form of voltage curve. Hence the two cases mentioned are by no means identical, but differ considerably. I know of no machine in practical service built with the poles arranged in the manner indicated for the purpose of increasing the shunt regulation range. On the other hand, many machines have been constructed in accordance with my proposal.

Baden, Switzerland. P. Amsler.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Braking of Alternating-Current Commutator Motors.—M. SCHENKEL.—The possibility of braking an alternating-current commutator motor in such a way as to return electrical energy to the supply system has been the subject of many recent discussions. It has been proved that such a possibility does not exist with single-phase series commutator motors. This proof is correct. But the conclusion

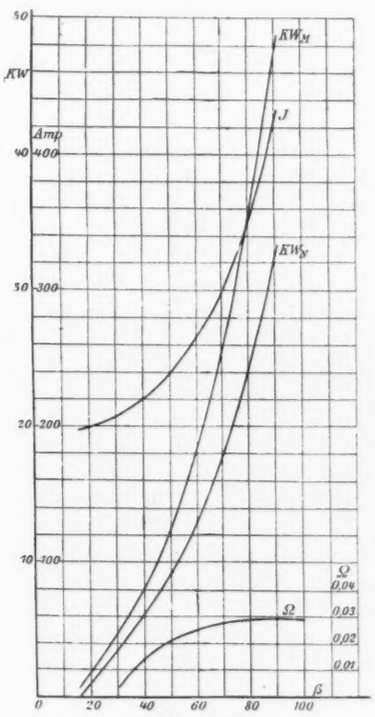


Fig. 1—Curves Showing Operating Characteristics of Motor Returning Energy to the Network.

has wrongly been drawn that the same is true for polyphase commutator motors. The author gives curves which show that with polyphase commutator motors a method of braking can be used by which electrical energy is returned into the network. The curves in Fig. 1 were determined experimentally. The motor which on braking returned energy to the network was a three-phase series machine. Stator and rotor windings were connected directly in series. This machine was driven by a direct-current motor. A three-phase generator of 100 kva which was also driven by a direct-current motor supplied current to the series motor through resistance. The voltage of the generator was 60; the speed of the three-phase series motor was maintained constant at 750 r.p.m.; the frequency was 50. At the same voltage, speed and frequency the three-phase series motor driven as a motor consumed 50 hp. By displacement of the brushes beyond the no-load position (indicated in the curve as zero degrees) the motor was transformed into a generator. Under the same conditions but without being driven it would have changed its direction of rotation and would have continued to run as a motor. To overcome the self-induction resistors were connected in each phase, their resistances being noted on the diagram. These resistors consumed relatively small power. The remaining energy was returned into the generator in such a way that the direct-current motor which was driving it not only was unloaded but returned current into its network. Fig. 1 gives the current J in amperes per phase, the resistance in ohms per phase, the power kw_m returned from the motor and the power kw_n returned into the network, the difference between kw_m and kw_n being the power consumed in the resistors. All powers were measured by wattmeters. The author shows with the aid of vector diagrams how these results can be obtained. This method is in commercial use.—*Elek. Zeit.*, Aug. 22, 1912.

Current and Power-Factor in Induction Motors.—H. J. S. HEATHER.—A note pointing out the general recognition of the fact that to any one value of the torque in an induction motor there correspond two values of the current, and similarly that to any one value of the power-factor there correspond two values of the current. From this it has apparently been wrongly assumed that the converses must hold good, and that to any one value of the current must correspond two values of torque and likewise two values of power-factor. This conclusion would be wrong, however, as is shown by the author with the aid of diagrams.—London *Electrician*, Aug. 23, 1912.

Compensated Dynamo.—A note on a recent British patent (No. 24,570, Aug. 1, 1912) of the British Thomson-Houston Company, Ltd., and A. G. Neild. For a divided field frame each of the poles near the division has a divided shoe. One part, being removable, is partly supported from the frame of the machine or the adjacent commutating pole shoe, so that when the upper part of the frame is removed the armature can be lifted out of its bearings.—London *Elec. Eng'ing*, Aug. 8, 1912.

Leakage Coefficient of Interpoles.—L. A. DOGGETT.—Well-known authorities have suggested as leakage coefficients for commutating poles values in the neighborhood of 1.3 to 1.75. The present author shows, however, that as a result of experiment and theory the leakage coefficients are from 2 to 3.5.—London *Electrician*, Aug. 23, 1912.

Lamps and Lighting.

Color Photometry.—LORD RAYLEIGH.—The author refers to a recent remark of H. E. Ives: "No satisfactory theory of the action of the flicker photometer can be said to exist. What does it actually measure? We may assume the existence of a 'luminosity sense' distinct from the color sense. . . . If, for instance, there exist a physiological process called into action both by colored and uncolored light, a measure of this would be a measure of a common property." To the present author it occurred a long time ago that the adjustment of the iris afforded just such a "physiological process." The iris contracts when the eye is exposed to a bright red or to a bright green light. There must, therefore, be some relative brightness of the two lights which tends equally to close the iris, and this may afford the measure required. The flicker adjustment is complete when the iris has no tendency to alter under the alternating illumination. This question was brought home to him forcibly when in 1875 he fitted the whole area of the window of a small room with revolving sectors after the manner of Talbot. The intention was to observe, more conveniently than when the eye is at a small hole, the movements of vibrating bodies. The apparatus served this purpose well enough, but incidentally he was struck with the remarkably disagreeable and even painful sensations experienced when at the beginning or end of operations the slits were revolving slowly so as to generate flashes at the rate of perhaps three or four per second. The author suggests that experiments be undertaken to ascertain whether in fact the flicker match coincides with quiescence of the iris.—*Philosoph. Mag.*, August, 1912.

Neon Lamp.—SCHROETER.—A note on a paper read before

the German Association of Central Stations. The author compared the Moore tube lamp with the neon lamp, and said that with neon gas the peculiarity of the light effect remains intact, but the quadruple illumination is obtained per unit length of the tube in comparison with nitrogen gas. The author emphasizes the high conductivity of neon gas, but states that when only a trace of ordinary gas is added to neon the conductivity is reduced to that of the addition. The neon lamp is of relatively high efficiency. The original difficulties with the neon lamp were the liability of the gas getting spoiled by impurities and the gradual absorption of gas in the electrode metal. Both of these troubles have been overcome. The neon lamp is especially suitable for "effective" lighting; in combination with the green mercury vapor lamp it is also suitable for lighting factories and workshops.—*Elek. Zeit.*, Aug. 8, 1912.

Generation, Transmission and Distribution.

Equalizing Power Fluctuations in Central Stations.—A. Schwaiger.—The first part of a long paper illustrated by diagrams on methods of equalizing the fluctuations of the load in power stations by means either of storage batteries or of flywheels. In both cases electrical energy is stored at moments of light load and given up again at the moments of overload. In the battery the energy is stored in the form of chemical energy, in the flywheel in the form of kinetic energy, and in order to give off energy at times of overload the battery must decrease in emf and the flywheel must reduce its speed. If the voltage variation or the speed variation is produced automatically by the load fluctuations, the author speaks of natural systems for equalization of load fluctuations. If these natural systems are not sufficient to produce the desired equalization of the load curve, artificial means, involving regulators, must be employed. In the present employment the author discusses the natural systems, taking up first the systems employing storage batteries and second the systems employing flywheels. Diagrams of the connections in the various possible systems are given. The article is to be continued.—*Elek. Zeit.*, Aug. 15, 1912.

Electro-Hydraulic Steering Gear.—An illustrated description of the electro-hydraulic steering gear installed on the steamship *Orama* according to the Hele-Shaw-Martineau patents. A feature of the process is the use of a continuously running electric motor, protected from shocks upon the rudder from the sea, which transmits its power by means of a pump and hydraulic cylinders attached to the rudder stop. The pump must be so arranged that its flow can be instantaneously stopped or directed by the steersman to either of the hydraulic cylinders operating the rudder.—London *Elec. Review*, Aug. 9, 1912.

Traction.

Electromagnetic Track Brake.—In the Reichsanstalt report for 1911 mention is made of an investigation of the electromagnetic track brake. A preliminary investigation was made of the disk form of eddy-current brake with a single pair of poles. The essential results are as follows: The increase of the braking effect with speed is proportional to the speed for low speeds. Later on the braking effect may increase somewhat more quickly than the speed if a very small air-gap is used or somewhat more slowly if a very large air-gap is used. In both cases the braking effect reaches a maximum for a certain speed and then decreases to zero for very high speeds. The maximum in the braking effect curve is pointed with short pole shoes and very flat with stretched pole-shoe forms.—*Elek. Zeit.*, Aug. 15, 1912.

Gasoline-Electric Automobiles.—J. Simey.—The conclusion of his article on various types of gasoline-electric automobiles. In the present instalment is discussed the Pieper system, in which a gasoline engine drives directly the wheel axle and also a single direct-current machine. The latter operates at times as a generator and at times as a motor. It furnishes the power required for starting and for climbing grades. It is connected with a storage battery which is charged when the automobile stands still or runs down hill, while it discharges at starting and running up hill.—*La Lumière Elec.*, Aug. 10, 1912.

Single-Phase Traction.—W. Kummer.—An English translation of his recent German paper on various problems of design in connection with single-phase traction.—London *Electrician*, Aug. 23, 1912.

Installations, Systems and Appliances.

Heat-Storage Apparatus for Equalizing the Load Curve of Central Stations.—A. Rittershausen.—The author emphasizes that the chief problem of central stations is the equalizing of the load curve and to encourage consumers to use energy during the daytime. This is possible only when the energy is stored in a form useful for domestic purposes. The author recommends the use of hot-water storage apparatus of the type shown in Fig. 2. The cold water enters at the bottom at *d*; the hot water leaves at the

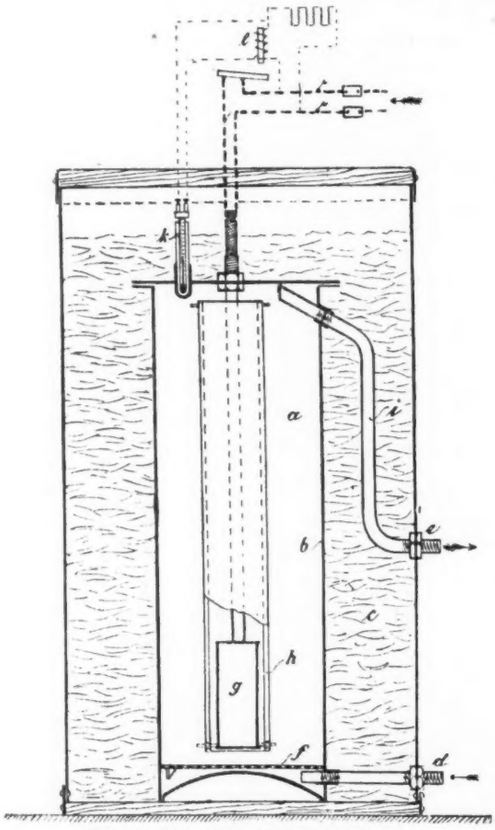


Fig. 2—Heat-Storage Apparatus.

top at *e*; *c* is a layer of kieselguhr which serves as a heat insulator. In order to make sure that hot water can always be drawn off from *e*, it is necessary that the cold water which enters through *d* shall not stir up the hot water above. For this reason the perforated plate *f* is provided. A definite circulation of the water is, however, necessary in order to heat the cold water. For this purpose the heating resistor *g* is surrounded by a cylinder *h*. The water within the cylinder is heated and rises, and cold water enters the cylinder from the bottom and so on. The author figures that the extensive use of such heat-storage apparatus would permit the sale of electrical energy at a price that makes it possible to heat all water needed for domestic purposes by electricity.—*Elek. Zeit.*, Aug. 22, 1912.

British Central Station.—An abstract of last year's report of the municipal station of Westham. The total number of kilowatt-hours sold for the twelve months ended March 31 last was 24,147,890, as against 22,690,266 in 1910-11. Private lighting accounted for 2,647,088 kw-hr., motor service and

heating for 15,193,859 kw-hr., public lighting for 735,200 kw-hr., and traction for 5,571,743 kw-hr. Private lighting shows an increase of nearly 400,000 kw-hr., or over 17 per cent. The generating cost per kilowatt-hour sold was 0.78 cent (against 0.68 cent the year before), the distribution cost 0.10 cent (against 0.10 cent), the management cost 0.10 cent (against 0.12 cent), the total cost exclusive of capital charges 1.30 cents (against 1.18 cents), the total cost including capital charges 2.02 cents (against 1.90 cents).—London *Electrician*, Aug. 16, 1912.

Alternating-Current Lifting Electromagnets.—A note on a recent British patent (No. 16,374, Aug. 8, 1912) of H. W. Lake and D. L. Lindquist. Currents in a primary coil induce currents in a secondary coil having a phase lag. Resistance and capacity are added to the secondary coil proportional to the frequency of supply, whereby chattering of the armature on the magnet is obviated. The secondary may be of ring or sleeve form, inclosing part of the core, and may be on the magnet or the armature. A permanent reluctance may be interposed in the magnetic circuit, and the armature is constructed to rock on a convexity on the end face of the magnet when it is in its attractive position for symmetrical adjustment.—London *Elec. Eng'ing*, Aug. 15, 1912.

Meter-Room Equipment.—E. P. AUSTIN.—An illustrated article on the suitable equipment of a testing room in a medium-size or small station for testing new and old service meters, resistance and insulation of cables, arc-lamp electrodes and dynamo brushes, etc.; also for checking from time to time the network-testing instruments, switchboard sets and similar devices.—London *Elec. Eng'ing*, Aug. 8, 1912.

Systems of Charging.—D. BERCOVITZ.—An English translation of his recent German paper on systems of charging for electric energy by contract in use in Continental Europe.—London *Electrician*, Aug. 9, 1912.

Electrophysics and Magnetism.

Electric Conductivity of Alloys.—A. E. WHITFORD.—An account of an investigation undertaken to study further the extent to which compounds as determined from the melting-point curve influence the trend of other physical properties of alloys. At 63 per cent Bi, corresponding to Bi_5Tl_3, the electrical conductivity curve shows a discontinuity, but the curve does not form an ordinary cusp at this point since its slope is steep on only one side of the point. At the other bismuth-thallium compound (10.9 per cent Bi) no discontinuity was detected. The characteristics of this curve agree well with those of the magnetic susceptibility curve of the bismuth-thallium series, where a well-formed cusp appears at Bi_5Tl_3, but no discontinuity is evident at the other compound point. The compound containing 10.9 per cent Bi, while it is of such a nature as to affect the melting-point curve, does not affect the conductivity or susceptibility curves.—*Phys. Review*, August, 1912.

Electrochemistry and Batteries.

Silicon Carbide.—F. A. J. FITZGERALD.—An illustrated description of the new plant of the Norton Company at Chippewa, Ontario, for the manufacture of crystolon (silicon carbide). Energy is supplied by the Ontario Power Company at 12,000 volts in the form of three-phase currents Since it was decided to use furnaces having a capacity of 740 kw and to install only two units, it was necessary to use transformers with suitable taps so that the three-phase currents are transformed to two-phase. The transformers reduce the emf to 145 volts. The secondary busbars then go to induction regulators by means of which the emf at the furnaces may be raised to 215 volts or lowered to 75 volts. The special conditions under which silicon carbide is found are discussed in some detail.—*Met. and Chem. Eng'ing*, September, 1912.

Electric Zinc Furnace.—W. McA. JOHNSON.—An illustrated article on his electric zinc furnace with special reference to a particular recent test made.—*Met. and Chem. Eng'ing*, September, 1912.

Dry Cell.—H. K. RICHARDSON.—An illustrated article describing the essential elements of the modern dry cell and the different steps in the method of manufacture. Figures of cost are also given.—*Met. and Chem. Eng'ing*, September, 1912.

Units, Measurements and Instruments.

Radium Standard.—W. NEUMANN.—According to the decision of the International Congress of Radiology and Electricity in Brussels, an international preparation of a radium standard has been made which is to serve in future as the unit for all measurements of radium preparations. The unit of radio-emanation is that quantity of emanation which is in radio-active equilibrium with a gram of metallic radium. It has the name curie.—*Elek. Zeit.*, Aug. 22, 1912.

Meter.—An official communication of the Reichsanstalt admitting a direct-current magnet motor meter of the Isaria Company for calibration. Its construction and method of operation are described.—*Elek. Zeit.*, Aug. 22, 1912.

Telegraphy, Telephony and Signals.

Telephone Exchange.—BLOHMER.—The first part of a long illustrated description of the new telephone exchange in Mainz, Germany, the central battery system being used.—*Elek. Zeit.*, Aug. 22, 1912.

Miscellaneous.

Magnetic Separation.—H. C. PARMELEE.—An illustrated article on zinc ore dressing in Colorado, describing the system of magnetic separation at the Wellington mill and at the Eagle Mining & Milling Company.—*Met. and Chem. Eng'ing*, September, 1912.

Electric Definitions.—F. G. BAILY.—A long letter criticizing various definitions recently proposed by the sub-committee on nomenclature of the International Electrotechnical Commission.—London *Electrician*, Aug. 23, 1912.

Book Reviews

MANUAL FOR ENGINEERS. 17th edition. Compiled by Charles E. Ferris, B.S., Knoxville, Tenn. University Press. 169 pages. Price, 50 cents.

A small handbook, vest-pocket size, containing the usual tables and miscellaneous engineering data. It also briefly describes the engineering courses offered at the University of Tennessee.

HENDRICKS COMMERCIAL REGISTER. New York: S. E. Hendricks Company. 1574 pages. Price, $10.

"Hendricks Commercial Register" covers very completely the architectural, engineering, electrical, mechanical, railroad, mining, manufacturing and kindred trades and professions. The present is the twenty-first edition, which contains over 50,000 classifications, each representing the manufacturers of or dealers in some machine, tool, specialty or material required in the industries noted. The classifications are so arranged that the book can be used for either purchasing or mailing purposes. As an illustration, all manufacturers of a particular trade are classified under a general heading for mailing purposes, and then each firm or corporation is subdivided under as many classifications as all the varieties of its products call for. The register also gives much information following the names of thousands of firms in order to save the expense of writing to a number of firms for the particular article required. There are included the trade names of all articles classified in the book as far as they can be secured. These trade names are given in parentheses between the names and addresses under the classifications where they appear.

SIDE GUIDE AND GR

New Apparatus and Appliances

TEST OF PORTABLE ELECTRIC DRILL.

A recent test made on a ½-in., 110-volt portable electric drill manufactured by the Standard Electric Tool Company, Cincinnati, Ohio, is of some interest. The tests were made by placing the drill in an upright position under the spindle of an upright drill press, thus utilizing the press feed to force the drill against the work. Three tests in all were made. The table shows the result in each case. The time in seconds noted in the last column was that required to drill a hole in steel to a depth of 2 in. in each case.

Test Number.	Volts.	Watts.	Time in Seconds
1	95	*	52
2	110	450	67
3	120	650	35

*The power consumed on the first test fluctuated owing to the varying load on the drill, as the feed was too rapid to be uniform.

Test No. 1 was made at less than normal voltage and the drill was fed to the work under extraordinary pressure. The second test was made under normal conditions both as to voltage and load, approximating as nearly as possible the ordinary conditions of service. Test No. 3 was made with an abnormally high voltage and much faster feed than would be possible in actual practice. In none of these cases, according to report, was the drill damaged in any way either by overstressing or overheating.

PORTABLE ELECTRIC LAMPS.

In its line of portable electric lamps designed for household use the Phoenix Glass Company, Pittsburgh, Pa., has included many of pleasing design. The lamp here shown is provided with natural-colored tree-scene decoration. Other schemes employed involve the Adam decoration, which is of creamy brown color similar in appearance to old alabaster, and the Nile decoration, which is of soft, velvety pale-green tint.

Portable Electric Lamp.

SPACE-SAVING GALVANOMETER LAMP AND SCALE ARRANGEMENT.

Among the distinguishing features of the lamp and scale arrangement herewith illustrated are legibility and space economy. The "spot," or rather line, of light is brilliant enough to be easily seen in a light room. The "spot" is thrown directly upon a paper scale, and thus can be seen from an angle. Those who have used translucent scales will appreciate the advantage of the latter point, for with such scales the observer must be practically in front of the scale in order to see the "spot." The lamp and scale are mounted directly upon the front of the galvanometer, thus economizing space. This arrangement also makes adjustment easier, since both the galvanometer and lamp and scale are in front of the operator and he does not have to move from one to the other during the process of adjustment.

The lamp and scale may be mounted readily on galvanometers equipped with a plane mirror. The arrangement has been devised by the Leeds & Northrup Company, Philadelphia, Pa., for use with various types of galvanometers. Since all Leeds & Northrup galvanometers with which telescopes and scales are ordinarily used are provided with plane mirrors, the lamp and scale may be used with such instruments without necessitating any change.

The lamp and scale consists of a frame upon which are mounted a low voltage incandescent lamp, a lens, a total reflecting prism, a mirror held in an aluminum frame and a 0.5-meter scale. The operation of the instrument will be readily understood from an inspection of Fig. 2. The lamp provided with the instrument has been especially designed for use with this instrument. It has a single straight filament of high intrinsic brilliancy. It operates on 4 volts and requires a current of 0.5 amp. It may be operated either from a storage battery or from an ordinary lighting circuit. If run from a lighting circuit a fixed resistance must be put in series with the lamp. If a number of galvanometers are in use in a laboratory, the lamps may all be connected in series, and only one resistance unit used for all, this unit being of proper resistance to protect as many lamps as are in the circuit.

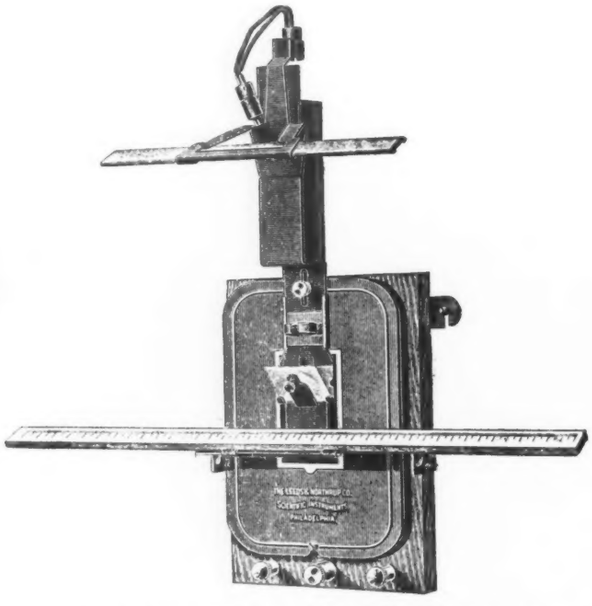


Fig. 1—Lamp and Scale Used with Galvanometer.

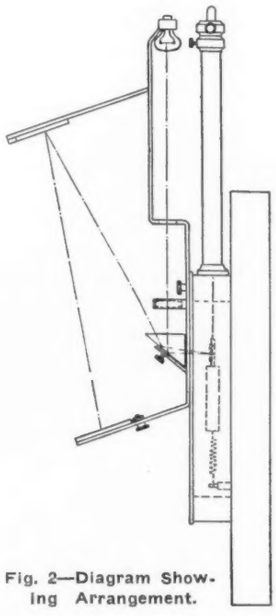


Fig. 2—Diagram Showing Arrangement.

LIFTING 5000 LB. OF PIG-IRON WITH 60-IN. ELECTROMAGNET.

The accompanying illustration shows 5000 lb. of pig-iron being lifted by a 60-in. electromagnet at the plant of the Inland Steel Company, Indiana Harbor, Ind. This magnet,

60-in. Electromagnet Lifting 5000 lb. of Pig-Iron.

built by the Electric Controller & Manufacturing Company, requires an exciting current of 47 amp at 220 volts. Ordinarily such a 60-in. magnet will lift about 2500 lb. of iron from the ground with the "pigs" lying flat, but by stacking the pigs vertically, as was suggested by experience in rapid handling of iron with a similar magnet at the Zenith furnace, Duluth, Minn., it is possible more than to double the lifting capacity of the equipment. With the pigs lying flat, the magnetic flux lines are required to cross considerable air-gaps, imposed by the rough surface of the iron, in reaching the pieces not in direct contact with the pole faces. By stacking the pigs vertically nearly all the sixty-one pieces shown in the picture made contact with the magnet and were readily lifted by means of the more effective utilization of the magnetic field.

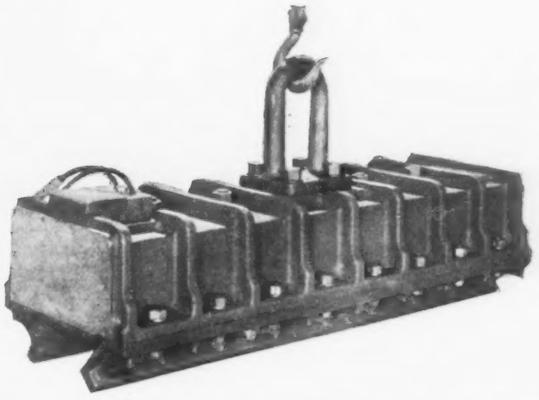
NEW INDUSTRIAL USES FOR ELECTROMAGNETS.

The Vancouver Salvage & Dredging Company, of Vancouver, B. C., has purchased a 43-in. electromagnet from the Cutler-Hammer Manufacturing Company, Milwaukee, which will be used for recovering sunken iron and steel objects in Puget Sound waters. The methods employed are similar to those recently used in raising a sunken bargeload of kegged nails in the Mississippi River near Natchez. The Vancouver magnet is of standard design and construction, with the exception of the terminal outlets, which have a special boxing filled with waterproof compound. The leads are inclosed in armored hose for a short distance back from the terminal box.

Rectangular or "chuck" magnets with interleaved pole pieces are being utilized to pull iron cores from pipe castings at the plant of the Central Foundry Company, Holt, Ala. The pipes are 6 ft. long and range from 2 in. to 6 in. in diameter. They are grouped in nests of twelve each in the molds, and after the molten metal has been poured and cooled the cores are withdrawn by the electromagnets through ho'es in the flask copes. With the interfaced magnet pole pieces used, a strong field is distributed over the entire face of the magnet, effecting powerful traction wherever the cores chance to be.

"Corner" magnets, like that shown in the illustration, are employed by the Asbestos Shingle, Slate & Sheathing Company to draw out the metal spacers that are placed between the 16-in. by 16-in. asbestos shingles during the process of baking in the ovens. After the shingles have been thoroughly fired the piles are removed in trays and the 17-in. by 50-in. magnet shown is dropped on to one corner, gripping the iron spacing sheets and drawing these from between the finished shingles.

A Cutler-Hammer electromagnetic separator has been used to advantage by the Southwestern Portland Cement



Electromagnet for Drawing Spacer Plates from Shingles.

Company, during the last eight months, to pick out foreign material from the coal fed to its driers. Before installing the magnet it had become a rare condition to run through a twelve-hour shift without changing the screens of the fuller mills. With the separator in use, the plant is now kept in continuous operation thirty days at a time without difficulty. Another new separation problem in linoleum factories is the removal of iron particles, and magnetic debris off the rolls, from the macerated material of which linoleum is made.

MULTIPLE-STAGE CENTRIFUGAL PUMP.

The Manistee Iron Works Company, of Manistee, Mich., have recently brought out in this country the Rees pressure-chamber type of centrifugal pump, which appeared on the foreign market some few years ago. The characteristic feature of this type of pump is the automatic regulation of the power consumption, secured by giving the impeller a large water-storage capacity. The water enters the pressure chamber from the eye of the impeller and is discharged, through guiding nozzles having a backward direction, to the external casing. Fig. 1 illustrates the general appearance of two-stage impellers mounted on an end shaft. The inner portion of the impeller between the eye and the largest section in the pressure chamber may be looked upon as con-

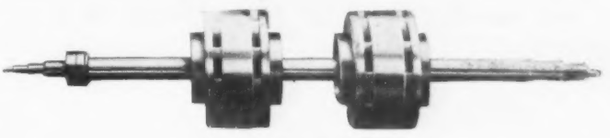


Fig. 1—Pump Rotor.

stituting the centrifugal pump proper, and the blades in this portion are designed similarly to those of an ordinary pump of this type. The rim portion beyond the pressure chamber is designed as a reaction turbine having the backwardly directed nozzles already mentioned, which discharge from the pressure chamber to the casing.

SIDE GUIDE AND GRI

The manufacturers claim that the power absorbed when running at constant speed remains practically stationary for all heads of discharge and height of suction and never appreciably exceeds that required for the total head for which the pump is designed, thus making it impossible for any variation of head or suction to overload the driving motor. There are no moving parts in contact except at the

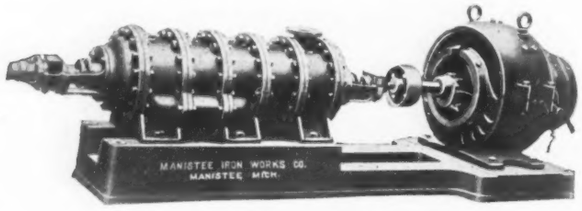


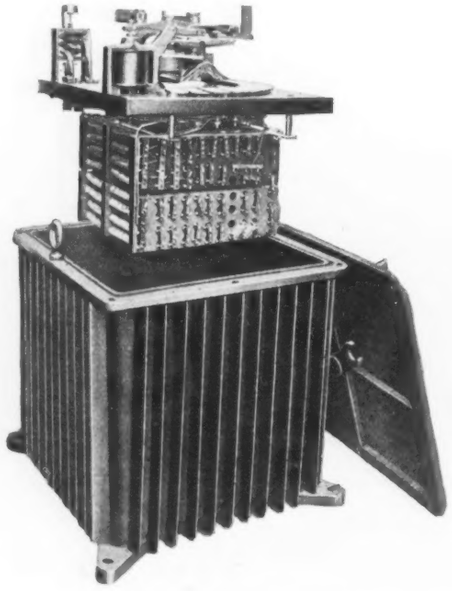
Fig. 2—Motor-Driven Centrifugal Pump.

bearings, and the internal arrangements are such that the whole pump is in hydraulic balance without end thrust on the shaft.

Fig. 2 represents the latest type of Rees boiler-feed pump directly connected to an inclosed direct-current motor. The pump impeller here consists of a series of pressure chambers which are mounted upon a central shaft supported on bearings throughout its entire length except for those portions passing through the chambers. The manufacturers state that this pump on test delivered 18,000 gal. of water per hour against a boiler pressure of 225 lb. per square inch, consuming 50 brake hp and developing a pump efficiency of 76.5 per cent.

OIL-IMMERSED MOTOR STARTERS.

In the starter here shown the switch and resistors are completely immersed in oil. This arrangement has been employed so that any arcing that may occur must take place



Oil-Immersed Motor Starter.

under oil. All contacts will be kept clean and the resistors will be cooled effectively. The starting switch and coils can be removed from the case by the withdrawal of four fixing screws and of the cables. The starter is of the slow-motion ratchet type, in which each stroke of the lever moves the switch arm definitely and quickly one step at a time, thus avoiding that hovering on the edges of the contacts which is the cause of so much destructive burning in slow-moving starters. This starter has been developed for use with direct-current motors by the Electrical Construction Company, Ltd., 9 New Broad Street, London, E. C.

COMPOUND STARTING AND REGULATING RHEOSTAT.

The compound starting and regulating rheostat illustrated herewith is a device, as its name indicates, for both starting and regulating the speed of direct-current shunt motors. In this rheostat, which is made by the Independent Electric Manufacturing Company, of Milwaukee, Wis., there are two resistors, one for the armature and another for the field circuit with corresponding levers.

When starting the motor the left-hand or starting lever

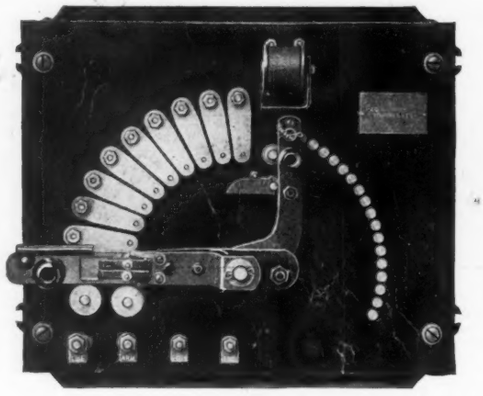


Fig. 1—Starting Position.

is moved slowly toward the right to the last or running position, where it comes in contact with the no-voltage release magnet, which holds it in this position. When the starting lever reaches its running position the right-hand or field-resistance lever is automatically unlocked. By moving the field lever to the right resistance is inserted, weakening the motor field and increasing the speed. The two levers are mechanically and positively connected, so that when the starting lever is at the "off" position the field lever must always be at the extreme left, or on the

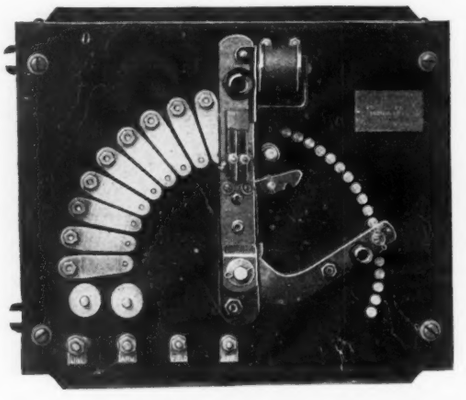


Fig. 2—Running Position.

first contact, where it is locked and remains so until the starting lever is in its running position and held in place by the release magnet.

Should the voltage at any time fail while the motor is in operation, the release magnet will let go of the starting lever and the hub spring in the lever will then cause it to fly back to the "off" position. This movement will also

return the field lever to its initial position and lock it there as before. The starting segments are easily replaceable, while the starting levers are of pressed steel equipped with automatically adjustable and removable brushes. The field resistor is composed of special high-resistance wire wound on asbestos tubes, the metal in which has no appreciable temperature coefficient. This rheostat has also been developed for use with overload as well as no-voltage release devices.

MANUFACTURERS AND JOBBERS AT PENNSYLVANIA ELECTRIC ASSOCIATION'S CONVENTION.

The fifth annual convention of the Pennsylvania Electric Association at Bedford Springs, Pa., Sept. 4, 5 and 6 was marked by a very large attendance of manufacturers of and jobbers in electrical apparatus, some of whom made exhibits. The great majority of the manufacturers, however, were content to have their representatives mingle with the central-station men during the week, evidently finding this to be advantageous from previous experience. Moreover, the entertainment features were in part carried out through the good-will of the manufacturers and jobbers, who donated all of the prizes, approximately seventy-five in all. These ranged from silver cups to small pocket flash-lamps and included many electric labor-saving household appliances. Those contributing to this end of the entertainment were as follows: Federal Sign System, Electric; Western Electric Company; Philadelphia Electric Company, Supply Department; Emerson Electric Manufacturing Company, through the H. C. Roberts Electric Supply Company; North Brothers Manufacturing Company; Westinghouse Electric & Manufacturing Company; Rumsey Electric Company; General Electric Company; Iron City Electric Company; Philadelphia Electrical Manufacturing Company; American Cross Arm Company; American Conduit Manufacturing Company; Union Electric Company; National Carbon Company; Doubleday-Hill Electric Company; Economical Electric Lamp Company; H. W. Johns-Manville Company; Illuminating Engineer Publishing Company; *Electrical Review and Western Electrician;* Simplex Electric Heating Company, and the Fostoria Lamp Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY had a display of electric meters of various types and a line of electric heating and cooking apparatus. Among the many representatives of the company present were Messrs. F. B. Albrecht, J. Andrews, Jr., E. W. Brown, V. Cohen, S. A. Fletcher, A. D. Fishel, J. J. Gibson, H. Gausman, F. W. Harrison, A. A. Morton, C. R. Powell, T. J. Pace, L. T. Peck, L. A. Sterrett, H. J. Solon and N. Williamson.

LUDWIG HOMMEL & COMPANY, Pittsburgh, made an exhibit in the room to the rear of the meeting room, where were shown Wagner meters and apparatus, Sangamo meters and samples of the products of the Condit Electric Manufacturing Company. In attendance were Messrs. L. Hommel and C. A. Swartz.

SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., showed a large array of electric heating and cooking appliances. The company was represented by Mr. E. B. Stebbins.

ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, had on view a pole type of Garton-Daniels lightning arrester, the features of which were explained by the company's representative, Mr. Brown.

OHIO BRASS COMPANY, Mansfield, Ohio, made a small display of suspension-type and pin-type porcelain insulators. Representing the company was Mr. Nathan Shute.

HUBBARD & COMPANY, Pittsburgh, in addition to distributing literature on the company's products had several samples of pole-line fixtures on exhibition on the hotel veranda. Mr. C. L. Peirce, Jr., was in attendance.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., displayed a number of wire and cable clamps, lamp guards, fault-testing outfit, pole fuse switch, lamp replacer, etc. Mr. V. L. Crawford was in attendance as the firm's representative.

WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., showed one of its unity power-factor single-phase motors on the veranda of the hotel. Messrs. F. N. Jewett, M. D. Koenig and J. Mustard registered as representatives of the company.

RUMSEY ELECTRIC COMPANY, Philadelphia, made a large exhibit of apparatus. The company represents the Bell Electric Motor Company, Garwood, N. J., manufacturers of single-phase and polyphase motors and direct-current generators and motors; Pelouze Electric Company, Chicago, manufacturer of heating appliances; Sangamo Electric Company, Springfield, Ill., manufacturer of meters; Roller-Smith Company, New York, builder of circuit-breakers, meters and testing sets; Pittsburgh High-Voltage Insulator Company, Derby, Pa., maker of porcelain insulators; Pittsburgh Transformer Company, Pittsburgh, manufacturer of transformers and constant-voltage series street-lighting systems, and the Electric Machinery Company, Minneapolis, Minn., builders of large motors and generators. The Rumsey Electric Company is one of the largest jobbers in the East and has been in business for seventeen years. The company's representatives were Messrs. J. H. Burroughs, D. C. Anderson, A. M. Goodloe, H. J. Schiefer, Jr., and A. A. Guardia.

Among the other companies represented at the convention were the following: Pittsburgh Transformer Company, Messrs. R. V. Bingay and H. G. Steele; H. T. Paiste Company, Mr. H. D. Winship; American District Steam Company, Messrs. C. R. Bishop, W. J. Kline and W. H. Wells; Doubleday-Hill Electric Company, Messrs. C. P. Hill, J. G. Attwell and D. W. Shaler; J. A. Roebling's Sons Company, Mr. R. J. Smith; General Vehicle Company, Mr. W. W. White; H. W. Johns-Manville Company, Mr. H. M. Voorhies; Hazard Manufacturing Company, Mr. C. E. Swanson; Excess Indicator Company, Messrs. M. Harris and W. L. Loeb; National Carbon Company, Messrs. C. F. Hill and F. H. MacDowell; Iron City Electric Company, Messrs. R. C. Murdock and C. W. Rindinger; Union Electric Company, Messrs. J. P. Provost and P. H. Schaum; A. F. Moore, Mr. A. Bournonville; Western Electric Company, Messrs. A. E. Beling, A. L. Hallstrom, E. E. Hedler, F. C. Jaeger, C. B. Price, J. G. Phillips, J. Sherman and J. Sigg; General Electric Company, Messrs. C. W. Bettcher, T. L. Griffin, J. M. Hayes, E. W. Howard, M. F. Knapp, J. J. Liles, W. L. Mason, H. W. Richardson, W. H. Rue, C. A. Raymond, G. Sachsenmaier, R. Troy, L. W. Teegarden, G. L. Thompson and M. P. White; National Electric Lamp Association, Messrs. R. E. Campbell and F. E. Mansfield; Buckeye Electric Works, Messrs. D. Craft, W. O. Conley, F. C. Foster and H. D. Porter; J. S. Stewart Electric Company, Mr. J. S. Connell; Federal Sign System, Electric, Mr. W. L. Donaldson; Philadelphia Electrical & Manufacturing Company, Messrs. W. O. Dale and J. L. Ludwig; H. C. Roberts Electric Supply Company, Messrs. F. M. Evans, H. G. Nichols and R. O. Meyrick; Bryan-Marsh Works, Mr. D. E. Eyeman; Safety Armorite Conduit Company, Mr. V. F. Gates; Colonial Electric Works, Mr. W. T. Hinton; Standard Underground Cable Company, Messrs. T. E. Hughes and D. C. Hamilton; American Conduit Manufacturing Company, Messrs. H. B. Kirkland and H. Winder; Peerless Lamp Works, Mr. H. H. Kundy; Holophane Company, Mr. H. W. Karsten; Pittsburgh Reinforcing Pole Company, Mr. W. A. McCombs; Elliott-Lewis Electric Company, Messrs. T. H. Lewis and T. E. Reger; Raphael Electric Company, Mr. H. M. Raphael; Frick & Lindsay Company, Mr. J. W. Smyth, and G. Sachsenmaier & Company, Mr. G. Sachsenmaier.

Industrial and Financial News

COMMENTS on the general improvement in the business outlook continue to be widespread. The crop reports are most promising and give stability to the whole situation. The volume of unfilled orders of the United States Steel Company, while not yet equal to past records, is approaching them and reflects the general business tendency. Bank clearings last week suffered a very slight loss in comparison with the previous week, but exhibited a gain of 9 per cent over the corresponding week a year ago.

The situation in the electrical industry is discussed elsewhere at some length by President Wheeler of the Crocker-Wheeler Company. It is worthy of note that he regards the status of the industry as a barometer of general business quite as reliable as some other factors more often referred to. American engine builders will be interested in our note on the development of the Diesel engine abroad. Among the operating companies the process of consolidation continues rapidly, and announcements of extensions and new financing are the order of the day.

Diesel Engine Situation Abroad.—Although the theoretical merits of the Diesel type of internal combustion engine are highly appreciated in this country, its use here has not kept pace with the developments abroad. Soon after Dr. Rudolf Diesel had obtained his fundamental patents he disposed of manufacturing rights to such firms as the Maschinenfabrik Augsburg-Nurmburg, Germany; the Krupp Works, Essen, Germany; Gebrüder Nobel, St. Petersburg, Russia, and Carels Brothers, Ghent, Belgium. After several years spent in experimentation and development these firms began to bring the Diesel engine into considerable prominence and demonstrated its practical value as a highly economical prime mover. The development has gone steadily forward, and, although the fundamental patents have now expired, many engine builders have taken licenses from the pioneer firms in order to have the benefit of their designs and shop experience. An American sales representative who has recently spent three months abroad investigating the situation reports that every shop which he visited is full of work on orders for Diesel engines, and that because of the large demand it is generally impossible to secure immediate delivery and in some cases from eighteen to twenty-four months' time is demanded. The activity abroad in pushing the Diesel engine commercially is well exemplified by the following list of prominent builders of engines of this type in Europe: Maschinenfabrik, Augsburg-Nurmburg, Germany; the Krupp Works, Essen, Germany; Gebrüder Nobel, St. Petersburg, Russia; Gasmotoren Fabrik, Deutz-Cologne, Germany; Aktiebolaget Diesels Motorer, Stockholm, Sweden; Gebrüder Sulzer, Winterthur, Switzerland; Mirlees, Bickerton & Day, Stockport, England; Carels Brothers, Ghent, Belgium; Diesel Engine Company, Ltd., London, England; Gebrüder Koerting Aktiengesellschaft, Hanover, Germany; Franco Tosi, Legnano, Italy; Nederlandsche Fabrik, Amsterdam, Holland; Langan & Wolf, Milan, Italy, and Burmeister & Wain, Copenhagen, Denmark. The four-cycle engine was the type generally built until some six years ago, when a few of the larger concerns undertook the development of the two-cycle engine. The four-cycle type is being built from the small size up to 600 hp or 700 hp. The two-cycle engine, although not quite as economical in fuel consumption, appears to be meeting with favor, and units are now being built in several large plants in capacities ranging from 750 hp up to 6000 hp. The Diesel engine is under consideration by many central-station companies for peak-load service and emergency standby, on account both of its economy and the great facility with which it can be placed in operation at short notice. The engine-building firm of Carels Brothers, of Belgium, is devoting its entire shop facilities to building Diesel engines, and is just building a shop addition which will permit it to double its output. The reliability of the Diesel type of engine of foreign make is illustrated by some of the large orders recently placed. The city of Bucharest, Roumania, has recently bought its sixth 700-hp engine of the four-cycle type and a 2250-hp engine of the two-cycle type. The Administration Communale of Brussels is installing a 1000-hp, two-cycle engine, with space provision for additional units. The Compagnie Générale d'Électricité, Paris, is installing a 1000-hp, two-cycle engine for substation service. There are several hundred installations of the four-cycle type of engine in the smaller cities and also many installations of the large two-cycle type in electric plants in the larger cities, including Zurich, St. Chamond and Luzerne.

President Wheeler of the Crocker-Wheeler Company on the Business Situation.—Dr. Schuyler Staats Wheeler, president of the Crocker-Wheeler Company, stated recently to a representative of the *Electrical World* that the business outlook in the electrical industry is most promising. The remarkable increase which has taken place in general business, he said, is prominently reflected in the tendency toward higher prices. During the last half year the factories have filled up with business at a cumulative rate, which is now far above the average. "The comparatively long dull period just passed," he said, "has been utilized by the industries in preparing plans for betterments and expansions, but commitments have been avoided until returning confidence and the approach of better times were apparent. Then followed a condition which can better be described as a stampede than a normal accession of orders. Therefore at present we have not only the world's normal business to take care of, but in addition we have the orders resulting from all the elaborate and wonderful plans for better equipments with which the managers of the country's industries have been occupying their minds through the three years' idleness. The consequence is that prompt deliveries are being sought but are made only with difficulty. Premiums for the time element are the results. Our own business for July and August shows a considerable increase over that of June and an astonishing increase over that of July and August last year. I expect this increase to continue steadily and believe that all of the big electrical companies will have a remarkable year. So many businesses are now using electricity either for their processes or for the mechanical operation of all their machinery that I consider the state of the electrical trade as good a barometer of the industrial condition of the country as the Clearing House or the Stock Exchange is of its financial condition. It is difficult to say what class of equipment is in greatest demand because, while the large pieces of apparatus attract most attention, the aggregate of the smaller machinery which goes out practically unnoticed amounts to a surprising total. Large generators driven by waterwheels, motors, steam engines or steam turbines, and also big power transformers, are probably the staples of demand in the electrical market. It is not easy to explain the several kinds of demands for electrical apparatus which make a total demand which has increased out of proportion to the increase in general business. As a generalization I should say that, in addition to the increase resulting from and in proportion to the increased general prosperity, the prospective crops and the rapid development of the South, there is another distinct factor, namely, the introduction of electrical methods into new fields. In other words, we are twice as busy as usual because industries already using electrical apparatus are twice as busy as usual, and we are twice as busy again because entirely new enterprises like wireless telegraphy, newly invented chemical processes and other new consumers of electricity are now creating a great additional demand for electrical apparatus."

Expansion of Central Illinois Public Service Company.—The Central Illinois Public Service Company, of Mattoon, Ill., has been taken over by the Middle West Utilities Company of Chicago, of which Samuel Insull is president. Since the control of the company passed into the hands of the Insull company its activities have been greatly increased. The company has operated plants in Mattoon and Charleston, Ill., including the public-utility properties that were con-

troiled formerly by P. S. Grosscup, of Chicago, formerly United States Circuit Court judge. Marshall E. Sampsell, of Chicago, continues as president of the company, and is in charge of the management under the general oversight of the executive officers of the Middle West Utilities Company. To the original properties of the company have been added, under the new régime, about thirty public-service properties in various small towns in central Illinois, extending from the Indiana line to the Mississippi River. No doubt, many of the small generating plants will be shut down, energy being supplied by transmission from a few larger plants. The capitalization of the company includes $3,500,000 of common stock, $2,500,000 of preferred stock, $3,000,000 of first and refunding mortgage bonds and about $700,000 of underlying bonds. Of the preferred stock $1,000,000 is retained in the company's treasury. The interest of the Middle West company is in the junior securities. At Kincaid, Ill., a new steam generating station with an initial rating of possibly 10,000 kw, which may be increased as time goes on to 25,000 kw, will be built. This station is in the coal-mining region and will be virtually at the pit's mouth. It will feed into the network of the Central Illinois company, but its main function will be to supply energy for the operation of nearby coal mines.

Annual Report of Interborough Rapid Transit Company.—The full pamphlet report of the operations of the Interborough Rapid Transit Company for the year ended June 30 was recently made public. The total operating expenses for the year were $13,047,802, an increase over the previous year of $678,820, and the net surplus for the year was $3,023,766. This amount included $900,000 received from the dividend on the capital stock of the Rapid Transit Subway Construction Company, the first dividend paid by that company since its organization in 1900. Excluding this dividend, the net corporate income for the year was $5,623,766, equal to 16.07 per cent on the capital stock of the company, as compared with 14.68 per cent for the preceding year. The gross operating revenue on the subway division increased 9.34 per cent, while the net revenue increased 8.93 per cent. The gross operating revenue on the Manhattan Railway division increased 0.9 per cent, while the net increased 0.53 per cent. During the year there was an increase of $3,407,000 in the 5 per cent gold-mortgage bonds outstanding, bringing the total up to $33,959,000. The total amount expended for additions and betterments on subway and elevated lines chargeable to capital account was $1,417,271. The total assets given in the balance sheet amounted to $104,710,222. The present surplus amounts to $8,531,261.

Development Plans for the Telluride Power Company.—As noted in the Aug. 3 issue of the *Electrical World*, the controlling interest in the Telluride Power Company has passed from L. L. Nunn and his brother and their Cleveland associates to a syndicate represented by Hayden, Stone & Company, the Electric Bond & Share Company and Joseph R. Nutt, of Cleveland, Ohio. At the present time this power company is developing only about 20,000 hp, but it is reported that additional developments can easily be made which will bring the total output up to 100,000 hp. It is announced that the contract of the Utah Copper Company, which has been obtaining all of its electrical energy from the Telluride company, will expire on Jan. 1 next and will not be renewed owing to reported dissatisfaction over the price and character of service. It is also reported that this situation culminated in bringing about the sale of the controlling interest to the syndicate before mentioned. The new interests, it is said, intend to develop the property on a large scale, with a twofold purpose in view: first, to provide cheap and adequate power for the development of large low-grade mining districts in Utah, and, second, to develop the sale of electric power for irrigation pumping. The new interests in control of the company will place D. C. Jackling in executive charge.

Hydroelectric Negotiations in Connecticut.—It is understood that the Stone & Webster interests of Boston are negotiating for the purchase of the water-power rights of the Connecticut River Company at Windsor Locks, Conn., and that in case the deal goes through upward of $4,000,000 will be expended in the development and acquisition of the property. It is proposed to build two dams in the river on either side of Kings Island, which is north of the Warehouse Point bridge of the New York, New Haven & Hartford Railroad, with various locks which may be presented to the federal government and which are to be operated and illuminated by electricity. A 7-ft. channel will also be dredged in the river, providing for the completion of a 7-ft. waterway from Holyoke, Mass., to Hartford, Conn. The Connecticut River Company, of which A. D. and H. R. Coffin are the principal stockholders, is a Connecticut corporation capitalized for $200,000. It has not paid any dividends in the past thirty years. The rehabilitation and development of the property, which includes the possibility of an extensive hydroelectric installation within a short distance of all the important cities of the Connecticut Valley, will be carried out by the Stone & Webster Engineering Corporation in case the present owners agree to the terms offered.

New Stock of Shawinigan Water & Power Company.—The shareholders of the Shawinigan Water & Power Company, Montreal, Can., recently voted unanimously to authorize a new stock issue of $5,000,000, and immediately afterward the directors passed a resolution to issue at once $1,000,000 of the new stock to be offered to present shareholders at $120. The company's business has been growing very rapidly, and additions to its hydroelectric plants are said to be absolutely necessary. During the past year a new hydroelectric plant with an ultimate capacity of 75,000 hp was constructed. It is equipped with a present capacity of 30,000, and new funds are required in order to pay for these additions and to provide for future extensions.

Indiana Utility Consolidations.—The Northern Indiana Utilities Company, recently organized by Chicago financiers, has secured control of the properties at Monticello, Walcott, Earl Park, Fowler and Kentland. Plans have also been announced to take over the lighting companies in all of the other small towns between Monticello and the Illinois state line. Transmission lines will be extended from the hydroelectric generating station now in operation at Monticello to the other towns, thus making it possible to shut down the small uneconomical steam plants. The initial capital stock of the holding company is $1,075,000. Samuel Insull, of Chicago, is president.

August Statement of Copper Producers' Association.—The monthly statement of the Copper Producers' Association for August shows that the stocks on hand Sept. 1 were 46,701,374 lb. The total consumption during August was 149,207,568 lb., of which 78,722,418 lb. was for domestic use and 70,485,150 lb. for export. The August production was 145,628,521 lb., or about 3,580,000 lb. less than the consumption. The stock on hand on Aug. 1 was 50,280,421 lb. Although the August production exceeded the output of any previous month for the two preceding years, the consumption increased in greater ratio and brought about a small decrease in the surplus stocks.

Texas Utilities Merged.—The Texas Utilities Corporation, recently organized to take over a number of central-station properties in the cities of northern Texas, has recently acquired the entire property of the Palestine Electric & Ice Company, of Palestine, Tex. The new owner, it is reported, will double the present capacity of the plant and make various other improvements and extensions. It is also reported that the holding company is considering the feasibility of constructing an interurban electric line between Dallas and Palestine, which will be about 100 miles in length.

Appalachian Power Company's Business.—Recent reports from the Appalachian Power Company state that several new contracts amounting to about 650 hp have been secured, and the company's business in general is increasing rapidly. The volume of business already contracted for, it is stated, will be sufficient to defray all operating costs and bond interest, and new contracts under negotiation are expected to provide returns which will more than care for the dividend on the preferred stock.

Guarantee Electric Company to Be Sold.—By order of the executors of the estate of the late owner, the business of the Guarantee Electric Company of Chicago is offered for sale. The business was established fifteen years ago by Charles E. Gregory, but Mr. Gregory sold out several years ago. The company deals in new and second-hand electrical machinery, does a repair business and rents motors, etc.

Projected Hydroelectric Developments in Alabama.—Reports from Montgomery, Ala., state that the commencement of operations to develop approximately 500,000 hp from Alabama waterways is the most important material achievement in that locality within recent years. The waterways of the State are already producing 175,000 hp, in 1382 plants. Within the past year practically all of the water-power sites in the State have been acquired, it is said, by the Alabama Interstate Power Company, a corporation supported by English capital. This company has already commenced construction work at Locks 12 and 18 on the Coosa River, and preliminary work is under way at Cherokee Bluff on the Tallapoosa River, where about 400,000 hp will be developed. Each of these points is within 40 miles of the city of Montgomery.

New Bonds of Pacific Gas & Electric Company.—Application has been made to the California Railroad Commission by the Pacific Gas & Electric Company for permission to issue $5,000,000 of new bonds, to be a portion of the $150,000,000 authorized issue, of which $20,000,000 are now outstanding. It is understood that the proceeds of this issue will be applied largely to the new hydroelectric developments on the Yuba River, in Nevada County, and on the Bear River, in Placer County. It is also stated that a portion of the proceeds will be used for the purchase of the properties of the Los Gatos Ice, Gas & Electric Company, for which it is said a price has been agreed upon at $187,762.

General Electric Stock.—On Dec. 31, 1912, the General Electric shareholders of record of that date will receive a dividend of $30 a share payable at par in stock of the company. This will make the equivalent of 32 per cent which the shareholders will receive up to the first of next year. Commencing Sept. 6 the stock sold ex dividend. Selling ex dividend 2 per cent would bring the market price down to about $180, and the market value after the distribution of the 30 per cent stock dividend on this basis will be about $138, which is regarded by many as a low price for an 8 per cent stock having a record and earning power like those of the General Electric.

Idaho Tax Valuations on Hydroelectric Properties.—The State Board of Equalization of Idaho has appointed a subcommittee to investigate the valuation for taxation purposes placed upon the hydroelectric properties in that State. It has been charged that these valuations are entirely too low in comparison with the earning power of the plants. The property of the Washington Water Power Company, Post Falls, is valued at $2,654,841; that of the Telluride Power Company at $673,447; the Idaho Consolidated Power Company, $50,600, and the Great Shoshone & Twin Falls Water Power Company, $200,000.

Allis-Chalmers Stock Assessments.—The date for payment of the balance, or 90 per cent, of the Allis-Chalmers preferred stock assessment of 20 per cent, and of the common stock assessment of 10 per cent, remains indefinite. The $18 assessment on the preferred stock and $9 assessment on the common was set for any date on or after Oct. 1, after thirty days' notice, but no notice has yet been given. This date will be fixed at a meeting of the reorganization committee, but it is reported probable that no payment will have to be made before Nov. 1 or later.

Iowa City Gas & Electric Property Sold.—The Western Utilities Company, which is financed by Chicago and Grand Rapids interests, has purchased all of the stock of the Iowa City Gas & Electric Company, Iowa City, Ia. This property lies in the heart of the territory served by the United Light & Railways Company, and it is reported that the stock may be transferred to that company in the near future. The purchase is said to have been brought about by Frank T. Hulswit, of Grand Rapids, president of the United Light & Railways Company.

Receivers Appointed for the United States Motors Company.—As we go to press announcement is received that Judge Hough, of the United States District Court, has appointed W. E. S. Strong and Roberts Walker as receivers for the United States Motors Company on allegations of insolvency made by the Brown & Sharpe Manufacturing Company, Providence, R. I. The capital stock of the Motors Company is $11,499,733 preferred and $12,205,350 common.

PRICES IN NEW YORK METAL MARKET.

	Sept. 3 Bid.	Sept. 3 Asked.	Sept. 10 Bid.	Sept. 10 Asked.
Copper:				
Standard:				
Spot	17.25	17.62½	17.25	17.75
September	17.25	17.62½	17.25	17.37½
October	17.35	17.62½	17.25	17.40
November	17.30	17.62½	17.25	17.50
London quotation:	£ s d		£ s d	
Standard copper, spot	79 6 3		78 10 0	
Standard copper, futures	79 15 0		79 5 0	
Prime Lake	17.60 to 17.65		17.65 to 17.75	
Electrolytic	17.55 to 17.65		17.60 to 17.70	
Casting	17.37½		17.50	
Copper wire, base	19.00		19.00	
Lead	4.80		5.10	
Sheet zinc, f.o.b. smelter	8.75		8.75	
Spelter, spot	7.37½		7.50	
Nickel	40.00 to 41.00		40.00 to 41.00	
Aluminum:				
No. 1 pure ingot	21½ to 22½		22 to 23	
Rods and wire, base	32		32	
Sheets, base	33½		33½	
OLD METALS.				
Heavy copper and wire	15.75		15.75	
Brass, heavy	10.00		10.00	
Brass, light	8.25		8.25	
Lead, heavy	4.60		4.85	
Zinc, scrap	5.75		5.87½	

COPPER EXPORTS IN AUGUST.

Total tons, including	Sept. 3, 29,526	Sept. 10, 6118

STOCK MARKET PRICES.

	Sept. 4.	Sept. 11.
Allis-Chalmers	¼*	⅜*
Allis-Chalmers, pf.	2½	1
Amalgamated Copper	86¼	85⅞
Amer. Tel & Tel.	144⅜	143⅞
Boston Edison	291*	291*
Commonwealth Edison	138	140
Electric Storage Battery	57	57
General Electric	182½	180
Mackay Companies	87½	89
Mackay Companies, pf.	69⅜	70
Philadelphia Electric	23⅝	24⅜
Western Union	81½	81⅛
Westinghouse	86½	86½
Westinghouse, pf.	124	124

*Last price quoted.

Personal

Mr. Robert Sealy has been appointed sales manager of The Milwaukee Electric Railway & Light Company, succeeding Mr. Egbert Douglass, who resigned to enter the Byllesby organization.

Mr. M. F. Flynn has been appointed district sales agent for The Milwaukee Electric Railway & Lighting Company in its central district. Mr. Flynn was formerly the heating-appliance expert for the company.

Mr. William L. Day has been elected vice-president and general manager of the General Motors Truck Company, Pontiac, Mich. Mr. Day was formerly general sales manager of the Mitchell-Lewis Motor Company, Racine, Wis.

Mr. Cale R. Gough, until a short time ago secretary, treasurer and manager of the Laurenceville (Ill.) Light & Water Company, which was recently sold to the Central Illinois Public Service Company, has purchased the capital stock of the Sparta Gas & Electric Company, of Sparta, Ill., and will take charge of the property next month.

Mr. John Fay, who was formerly superintendent of overhead lines for the Union Electric Light & Power Company, St. Louis, and later served on the sales staff of W. N. Matthews & Brother, St. Louis, has been appointed superintendent of distribution for The Milwaukee Electric Railway & Light Company, having charge of both electric-lighting and trolley-line construction.

Mr. James S. Cummins, of the law firm of Cummins, Stearns & Milkewitch, Chicago, counsel for H. M. Byllesby & Company, addressed the Byllesby Luncheon Club in the Great Northern Hotel, Chicago, on Sept. 4, giving some early reminiscences of the organization. Mr. E. L. Callahan, head of the commercial department, was scheduled to address the meeting of Sept. 11.

President Carl A. Rossander, of the Swedish Electrotechnical Committee, Stockholm, and **Dr. Alfred Ekstrom,** managing director of the Hemsjö (Sweden) Hydroelectric Power Company, are spending the month of September visiting the eastern portion of the United States for the purpose of investigating American practice in hydroelectric development, high-tension transmission, electric and district steam heating.

Mr. Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, was, on Sept. 1, 1912, presented by the employees of the company with a loving cup in recognition of his twenty-five years of service. Charles Leavitt Edgar was born at Griggstown, N. J., on Dec. 23, 1860. He was graduated from Rutgers College in 1882 and spent one year in post-graduate work in electrical engineering. In 1883 he entered the employ of Mr. Thomas A. Edison in the testing department of the Edison Machine Works, Goerck Street, New York, where he spent nearly a year. In 1887 he became associated with the Edison Electric Light Company, and the position of superintendent of the Edison Electric Illuminating Company of Boston was given to him in September twenty-five years ago. In 1887 he was made general manager, subsequently vice-president, and in 1900, on the death of Mr. Jacob Rogers, was elected president of the company. When he assumed control of the company it had fifty-one employees, as compared with 1390 at the present time, and served 260 customers, as compared with 43,142, with a connected load of 439 kw, as compared with 152,446 kw. Much of the success of the company can rightly be attributed to the interest taken by Mr. Edgar in the welfare of its employees and their attitude toward the company and the public. He has served as manager of the American Institute of Electrical Engineers and chairman of its Boston Section and as president of the Massachusetts Electric Light Association, the Association of Edison Illuminating Companies and the National Electric Light Association.

CHARLES L. EDGAR.

Mr. William C. Anderson, who has just been elected treasurer of the Pennsylvania Electric Association, is manager of the Luzerne County Gas & Electric Company and a graduate of Lehigh University, class 1894. His first position after graduation as electrical engineer was with the East River Gas Company, which was then about to begin operations in New York City. Mr. Anderson remained with that company in various capacities until the fall of 1895, when he joined the inspection department of the New York Edison Company, leaving that company the following year to go with the Consolidated Gas Company of New Jersey as assistant engineer of construction at Long Branch. A few months later he was made district superintendent at Red Bank, which station he filled until early in 1900. For a year following Mr. Anderson was manager of the Gas Company of Montgomery County at Norristown, and for the next two years he acted as superintendent of the Port Chester district of the Westchester Lighting Company. The Stanley Instrument Company next engaged Mr. Anderson and sent him to Europe as engineer in the foreign sales department at Paris. In September, 1904, Mr. Anderson accepted the post of manager of the Bergen County Gas & Electric Company, which position he filled until the following August, when the company was taken over under lease by the Public Service Corporation. He then assumed charge of what was then known as the Wyoming Valley Gas & Electric Company, which has since been called the Luzerne County Gas & Electric Company, the chief office of which is located at Plymouth, Pa. Within the past two years Mr. Anderson has shut down every municipal plant in his territory.

WILLIAM C. ANDERSON.

Mr. Albert Jackson Marshall, whose resignation from the Holophane Company to enter the consulting illuminating engineering field was noted in our issue dated June 29, 1912, has been appointed editor of *Good Lighting and the Illuminating Engineer.*

Mr. C. L. Morgan, until recently sales manager of the electric division of the General Motors Truck Company, Pontiac, Mich., has become associated with the Moon-Hopkins Billing Machine Company of St. Louis as Eastern sales agent, with headquarters at 350 Broadway, New York City.

Mr. W. R. McGovern, formerly engineer of the Wisconsin Telephone Company and for the past year engineer of inventory and appraisals for the so-called central group of Bell companies, has been appointed engineer for the district of Illinois, including all the property of the Chicago Telephone Company and the Central Union Telephone Company in the State. This is the largest district in the central group of companies.

Mr. Frederick Dwight Nims, electrical engineer of the Western Canada Power Company, who was recently re-elected chairman of the Vancouver Section of the American Institute of Electrical Engineers, was born in Muskegon, Mich., in 1877. In 1894 he entered the shops of the Muskegon Street Railway Company, and he remained in the employ of that company and of the Muskegon Electric Light Company until 1900, with the exception of the year 1898, when he served in the Spanish-American war in Cuba with the Thirty-fourth Michigan Volunteers. He then went into contracting business in Muskegon, which he gave up the following year to take charge of electrical work for the Muskegon Traction & Lighting Company, a consolidation of the companies mentioned above. Early in 1902 Mr. Nims went to Salt Lake City, where he became associated with Mr. R. T. Hayward, taking charge of the Big Cottonwood division of the Utah Light & Railway Company. Later he became assistant operating engineer of the same company and then general superintendent at Ogden, Utah. In September, 1905, he went to Mexico as chief operating engineer of the Mexican Light & Power Company. The work there involved the completion of the work on the Necaxa plant and the paralleling of the three existing systems in Mexico City, making one large system, besides the completion and operation of 600 miles of 60,000-volt circuit on steel towers. The completed system called for the operation of seven hydroelectric and four steam stations, together with thirteen main distributing substations. In 1909 Mr. Nims went to Vancouver as electrical engineer of the newly formed Western Canada Power Company. He is married and has two children. Mr. Nims is a member of the A. I. E. E. and helped organize the Mexico Section and the Vancouver Section of the Institute, the one farthest south and the other farthest north and west.

FREDERICK D. NIMS.

Obituary

Mr. W. W. Gale, president of W. W. Gale & Company, Inc., electrical contractors, of New Haven, Conn., was suddenly killed in an automobile accident on Sept 8. Mr. Gale was making an automobile trip to the New York State Fair at Syracuse, N. Y., and the accident occurred near Fonda, when the machine overturned was running at a high rate of speed. Mrs. Gale, who also occupied the car, received very serious injuries, the outcome of which is reported uncertain. Mr. Gale was well known to the electrical fraternity in Connecticut. He is survived by three sons and a sister.

Construction

BENTONVILLE, ARK.—The Cty Council has authorized E. T. Holt, city electrician, to purchase meters for the municipal electric system.

NEWPORT, ARK.—The City Council has granted a franchise to the Co-operative El. Co. Under the terms of the franchise the company is to install an electric-light and power plant within six months. The company is to furnish the city with 80 60-watt tungsten lamps for street-lighting service and also electricity for lighting the court house, city hall and sewer pumping station free of charge.

BURBANK, CAL.—The Pacific El. Ry. Co. is planning to build a permanent substation in Burbank. A portable station is now being used.

GREENVILLE, CAL.—The Indian Valley El. Co. has submitted an amended application to the State Railroad Commission, again asking permission to issue $250,000 in bonds.

HALF MOON BAY, CAL.—The State Railroad Commission has granted the Half Moon Bay Lt. & Pwr. Co. permission to operate in the Jefferson school district in San Mateo County.

KELSEYVILLE, CAL.—The State Railroad Commission has granted James A. Gunn, Jr., permission to supply electricity in the towns of Kelseyville, Lakeport, Upper Lake and surrounding territory in Lake County. The petition to furnish electrical energy in Lakeport was denied on the ground that the Mount Konocti Lt. & Pwr. Co. has previous franchises in that city and is furnishing electrical service there.

LATON, CAL.—The San Joaquin Lt. & Pwr. Co. contemplates extending its transmission line from Laton to Riverdale. The company will supply electricity for lamps and motors to the farmers residing along the line.

LOS ANGELES, CAL.—The Pacific El. Ry. Co. has applied for a franchise to build and operate a double-track electric railway from First Street to Ninth Street.

LOS ANGELES, CAL.—Property owners on Eighth Street between Hill and Figueroa Streets have filed a petition with the City Council asking for the installation of a lighting system on that street similar to that on Hill Street.

LOS ANGELES, CAL.—The Los Angeles Investment Co. has announced that it is willing to finance the city's electric railway to the harbor. The city is unable to increase its bonded indebtedness, but may be able to build the railway if the investment company advances the money.

MAXWELL, CAL.—The Northern California Pwr. Co. is erecting a transmission line to supply electricity for pumps north of Maxwell.

OXNARD, CAL.—All bids received for the construction of the proposed municipal electric-light plant have been rejected. New bids will be called for. Olmsted & Gillelen, Los Angeles, are engineers.

PLACERVILLE, CAL.—The Western States Gas & El. Co. will soon begin work on the construction of a transmission line to Camino. This line will furnish electricity to the Danaher Pine Co. to operate the mills in Camino. It is expected that the line will eventually be extended to Diamond Springs and El Dorado.

SACRAMENTO, CAL.—Plans are being considered for the installation of ornamental lamps in McKinley Park.

SAN DIEGO, CAL.—The Los Angeles & San Diego Beach railway, it is said, will be equipped for electrical operation, the cost of which is estimated at $100,000.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co. has applied to the State Railroad Commission for permission to issue $5,000,000 in bonds, of which part of the proceeds will be used in constructing two new hydroelectric plants on the south fork of the Yuba River in Nevada County and on the Bear River in Placer County. A high-tension transmission line will be erected from these two plants through Placer, Nevada, Yuba, Sutter, Yolo and Solano Counties to connect with the Pacific Gas & El. Co. at its center load.

SAN MIGUEL, CAL.—Preparations are being made by the Midland Counties Gas & El. Co. for the erection of a transmission line between the Coalinga field and Santa Maria, passing through the city of San Luis Obispo. A substation will be located in San Miguel.

STOCKTON, CAL.—The Oro El. Corpn., Oroville, is planning to enter the local field as competitor to the Western States Gas & El. Co. If granted a franchise the company proposes to erect a 2000-hp plant. It also contemplates furnishing electricity throughout the county for irrigation purposes.

VAN NUYS, CAL.—A committee consisting of G. O. Houghton, William Andrew and J. H. Heinen has been appointed to determine the lighting system to be used for the newly created Van Nuys highway lighting district.

VISALIA, CAL.—The Mount Whitney Pwr. Co. has authorized extensions to its system, including the erection of two new plants, which will develop 14,000 hp and cost about $1,000,000. One of the plants, to be known as Keweah No. 3, will be located on the upper Keweah River, a short distance from the border of the Sequoia Forest; the other on Wolverton Creek, a short distance from Giant Forest.

WOODLAND, CAL.—Preparations are being made by the Yolo Wtr. & Pwr. Co. for raising the level of Clear Creek 7 ft. or 8 ft. Work will soon begin on the dam to be built at the outlet, which is Cache Creek. Eventually several power houses will be built on Cache Creek.

PAONIA, COL.—The municipal electric-light plant was recently destroyed by fire, causing a loss of about $30,000.

CLINTON, CONN.—The Selectmen have been authorized to award contract for placing 110 electric lamps along the main thoroughfare from East River to Hammonassett River and along the shore from West Wharf to Waterbury Avenue and other streets.

NEW HAVEN, CONN.—The New York, New Haven & Hartford R. R. Co. is planning to build a large dam across the Housatonic River and an electric power plant near Zoar Bridge, 5 miles above Derby, and three smaller dams between that point and New Milford. The proposed plant will supply electricity for its main line between New Haven and Stamford and to all its divisions and electric railways in Western Connecticut. Work will begin next spring on the dam, which will be 35 ft. high and 600 ft. long.

STORRS, CONN.—Bids for the construction of a one-story power house at the Connecticut Colony of Epileptics are being received. Andworth & Woodworth, 148 Main Street, Norwich, are architects.

THOMASTON, CONN.—The Connecticut Pwr. Co. has leased the electric-light plant of the Thomaston El. Lt. Co. for 99 years. No changes will be made in the plant at present.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 21 for furnishing and installing lighting fixtures in the United States post office at Wellington, Kan., and United States post office and court house at Salt Lake City, Utah, in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 24 for furnishing at the navy yard, Brooklyn, N. Y., the following supplies: Schedule 4800—Electrical equipment; Schedule 4801—steel-plate fans; Schedule 4805—coaling trucks, etc.; Schedule 4809—porcelain plugs and receptacles; Schedule 4812—steel boiler plates. Applications should designate the schedule desired by number. Blank proposals will be furnished upon application to the navy pay office, New York, N. Y., or to the above bureau. T. J. Cowie, U. S. A., is paymaster general.

HASTINGS, FLA.—The Hastings Cold Storage Co. is planning to install an electric-light plant, material for which has been ordered. The town has contracted for 20 tungsten street lamps of 60 cp.

PENSACOLA, FLA.—The lighting committee contemplates the erection of ornamental street lamps from Palafox Street to the new Louisville & Nashville passenger station being erected at the corner of Wright and Alcaniz Streets.

AMERICUS, GA.—Steps have been taken by the Board of Trade for the installation of an ornamental street-lighting system in the business district.

MEIGS, GA.—Bids will be received by the city of Meigs for construction of an electric-light plant until Sept. 17. The equipment will consist of a 50-kw alternating-current generator, with three-panel switchboard and street-light regulator, high-speed automatic engine, etc. The C. W. Murray Co., Savannah, Ga., has charge of the work.

KELLOGG, IDAHO.—The Nabob Mining Co. has entered into a contract with the Washington Pwr. Co., Spokane, Wash, to erect a transmission line to its property on Pine Creek. H. M. Ross is manager of the mining company.

LAPWAI, IDAHO.—The Lewiston-Clarkston Improvement Co., Lewiston, contemplates extending its transmission lines to the Lapwai Valley.

LEWISTON, IDAHO.—Work, it is said, will soon begin on the construction of the proposed electric line to extend from Lewiston through the Camas and Nez Perce prairies, which will involve an expenditure of about $1,500,000. Z. A. Johnson, of Nez Perce, Idaho, is interested.

MONTPELIER, IDAHO.—Extensive improvements are contemplated by the Telluride Pwr. Co. to its system, involving an expenditure of about $1,750,000. The work includes the completion of the Bear River reservoir in Utah and Idaho, building of an irrigation system on Bear River at Soda Springs and a generating plant at Oneida Narrows.

ALTON, ILL.—The East End Improvement Association has appointed a committee, consisting of H. Beardslee, Chris Koenig and E. G. Herb, to investigate plans for an ornamental street-lighting system.

AUGUSTA, ILL.—The property of the Independent Lt. & Pwr. Co. has been sold to the Middle West Utilities Co., of Chicago. It is expected the energy for operating the local system will be supplied from the plant in Colchester.

CHICAGO, ILL.—The La Salle County El. Ry. Co. is planning to build a new power house in Prairie Center.

HARVEL, ILL.—The Village Board has granted a franchise to the Montgomery County Tel. Co.

JERSEYVILLE, ILL.—The Central Illinois Pub. Ser. Co. has purchased the property of the Jerseyville Illg. Co. in Jerseyville.

MACOMB, ILL.—The properties of the Macomb El. Lt. & Gas Co. have been purchased by the Central Illinois Pub. Ser. Co., Mattoon.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co. has awarded a contract to the Chuse Engine Co. for a 750-hp engine. Work will begin this fall on the erection of a transmission line to Neoga.

PITTSFIELD, ILL.—The property of the Union El. Service Co., including the local plant and the distributing system in Griggsville, has

been purchased by the Middle West Utilities Co., of Chicago. It is understood that the new owners will secure electricity for operating the system from the power plant at the Keokuk dam.

PLYMOUTH, ILL.—The local electric-light plant has been purchased by the Middle West Utilities Co., of Chicago.

PROPHETSTOWN, ILL.—The North Illinois Utilities Co., which recently purchased the local electric-light plant, has applied to the Village Board for a franchise to operate in Prophetstown.

TAYLORVILLE, ILL.—Trust deeds have been filed here to convey the plants of the Taylorville Gas & El. Co., Taylorville; the Pana Gas & El. Co., Pana, and the Edinburgh Lt., Ht. & Pwr. Co., Edinburgh, to the Central Illinois Pub. Ser. Co., of Chicago and Mattoon. This company has acquired public utilities plants in 30 cities in the central and southern part of the State and has secured options, it is said, on 35 or 40 more plants. Electrical energy for operating these plants will be generated at a large central power plant to be erected at Kincaid. A site has been purchased by F. S. Peabody, of Chicago, for a reservoir near Kincaid.

WATERTOWN, ILL.—The Village Board has awarded a contract to the People's Pwr. Co. for lighting the streets of the village for a period of five years. Twenty lamps of 80 cp will be installed.

COLUMBUS, IND.—The Citizens' Tel. Co. has increased its capital stock by $50,000.

MONTPELIER, IND.—Application has been made by J. P. Boyd, receiver of the Montpelier Lt. & Wtr. Co., to the County Commissioners for a franchise to extend its transmission lines in Wells County to supply electricity to residents outside of incorporated towns and cities. The company proposes to extend its lines as far north as Keystone, where it has applied for a franchise.

NEW ALBANY, IND.—The United Gas & El. Co., New Albany, is planning to extend its service to Sellersburg, Edwardsville, Galena and several other neighboring towns. Samuel Insull, Chicago, Ill., is president of the company.

NOBLESVILLE, IND.—The property of the Noblesville Gas. & El. Co. has been purchased by Chicago interests. It is proposed to connect the plant with Tipton, Ohio.

CEDAR FALLS, IA.—The City Council has authorized the light committee to engage an electrical engineer to prepare plans and estimates of the cost of building and maintaining a municipal lighting plant. The Citizens' Gas & El. Co., Waterloo, now supplies electrical service here.

CHURDAN, IA.—The proposition to install an electric-light plant and water-works system here will be submitted to a vote on Sept. 17. The cost of the electric plant is estimated at $10,000.

DES MOINES, IA.—Extensive improvements to its lighting system are contemplated by the Des Moines El. Co., which will involve an expenditure of about $15,000. W. H. Thomson, Jr., is local manager.

DES MOINES, IA.—Arrangements have been made whereby the ornamental street-lighting system will be continued. Owing to the reduction in price of electricity for maintaining the electroliers, it has been decided to increase the number of standards from 400 to 1000 within the next 18 months.

EPWORTH, IA.—Steps have been taken by the City Council toward the installation of an electric-light plant and water-works system.

HASTINGS, IA.—At an election held recently the proposition to grant the Glenwood El. Lt. & Pwr. Co., Glenwood, a franchise to install an electric-light system here was carried.

HENDERSON, IA.—The Glenwood El. Lt. & Pwr. Co., Glenwood, has been granted a 20-year franchise to supply electricity for lighting the streets and residences here. Energy for operating the system will be transmitted from Glenwood. The Council has contracted for 16 street lamps.

IOWA CITY, IA.—The property of the Iowa City Gas & El. Co. has been purchased by the Western Utilities Co., of Chicago. Frank E. Hulswit, Grand Rapids, Mich., has been elected president of the Iowa City company.

IOWA FALLS, IA.—Arrangements have been made to have an electrolier street-lighting system on two of the principal streets of the city. A franchise was recently granted the Dows El. Lt. & Pwr. Co. to install an electric-light plant here.

SHELDON, IA.—Steps have been taken by the local business men to substitute electroliers for the arc lamps in the business district.

WHITING, IA.—The Town Council is contemplating the installation of an electric light system here. It is proposed to secure electricity from the municipal electric plant at Onawa.

NORTON, KAN.—Bids will be received by the city of Norton until Sept. 20 for engines and electrical apparatus for the municipal electric-light plant. Plans and specifications may be obtained on application to the city clerk or to C. O. Lund, supervising engineer.

WHITE CLOUD, KAN.—Bonds to the amount of $5,000 for the construction of a new municipal lighting plant have been voted.

ANCHORAGE, KY.—The Louisville Ltg. Co. is contemplating extending its transmission lines to Anchorage to supply electricity for lamps and motors here.

COVINGTON, KY.—The Union Lt., Ht. & Pwr. Co. has submitted an estimate to the City Council of the cost of placing its wires underground. The cost of the work is placed at $58,705.

COVINGTON, KY.—The City Council is considering the question of engaging an engineer to prepare plans and supervise the construction of a municipal electric-light plant. The lighting committee has submitted its first report to Mayor Phillips relative to the proposition.

DANVILLE, KY.—Work has begun on the construction of a concrete dam across Dix River, near Danville. The dam will be 90 ft. high and will furnish power to generate electricity which will be transmitted to nearby cities and also to operate electric railways in this vicinity. L. B. Herrington, of Richmond, Ky., has charge of the work.

LOUISVILLE, KY.—The general contract for construction of a power house for the Louisville & Interurban Ry. Co., to be located at Nineteenth and High Streets, has been awarded to the Henry Bickel Co., Louisville, to cost about $300,000. The cost of the plant complete is estimated at $750,000.

PARIS, KY.—The contract for installing an electric light and power plant and electric elevators at the W. W. Massie Memorial Hospital has been awarded to the Danville Constr. Co., Danville, Ky.

WILMORE, KY.—The local electric-light plant and ice plant was recently destroyed by fire, causing a loss of about $10,000. The plant will be rebuilt at once.

SHREVEPORT, LA.—The Shreveport Trac. Co. has purchased a franchise to build and operate an electric railway between the city limits and the Cedar Grove factory addition, south of the city.

VILLE PLATTE, LA.—A franchise has been granted to L. J. Dossman, Opelousas, La., to construct and operate an electric-light plant here. An ice plant will also be installed.

WOOD, LA.—Plans are being considered by L. M. Fairbanks, president of the Mansfield Banking Co., for the installation of an electric-light and power plant here.

ANNAPOLIS, MD.—The contract for installing an underground distributing system at the United States Naval Academy has been awarded to the Carroll El. Co., Washington, D. C., for $57,290.

BALTIMORE, MD.—The Peabody Heights Improvement Association has petitioned the Park Board to install a street-lighting system in Wyman Park.

MOUNT WASHINGTON, MD.—The Mount Washington El. Lt. & Pwr. Co. contemplates extending its transmission line to Carney, on the Harford Road.

BOSTON, MASS.—It is reported that Mayor Fitzgerald is considering the question of lighting the entire city by electricity, substituting 40-cp incandescent lamps for gas lamps, which it is estimated would save the city $60,000 annually. The Edison El. Illg. Co., it is said, would furnish the lamps at $18 each per year. It is understood that the company will agree to place its wires underground.

CLINTON, MASS.—The Worcester Consol. St. Ry. Co. has petitioned the Board of Selectmen for a franchise to erect and maintain wires over several streets in the city.

FALL RIVER, MASS.—The aldermanic committee on street lights has voted to recommend to the Board of Aldermen the installation of 75 additional street lamps throughout the city.

NORTHFIELD, MASS.—The Greenfield El. Lt. & Pwr. Co. has applied to the Selectmen for permission to extend its transmission line over Birnam Road.

EATON RAPIDS, MICH.—The Commonwealth Pwr. Co. is planning to extend its transmission line from Charlotte to Eaton Rapids. The company proposes to supply electricity to the woolen mills here and will probably furnish power to other industrial plants.

BROWNTON, MINN.—Bids will be received by F. W. Booth, village clerk, until Sept. 20 for the construction of an electric-light plant, plans for which were prepared by Earle D. Jackson, engineer, St. Paul. The work includes furnishing and installing a three-wire generator, storage battery, pole line, street lamps, etc.

CLARKFIELD, MINN.—Steps have been taken by the Village Council to secure estimates for the installation of a municipal electric-light plant here.

HIBBING, MINN.—The water, light, power and building committee has engaged William Burgess, of the Burgess El. Co., Duluth, to prepare plans for the installation of an ornamental street-lighting system in the business district.

KIMBALL, MINN.—The Lethert El. Co., of St. Paul, has applied to the Council for a franchise to supply electrical service in Kimball.

PRESTON, MINN.—The Root River Pwr. & Lt. Co, which is planning to build a hydroelectric power plant on the Root River, will not award contracts for construction of the plant but will do its own work. The cost of the work is estimated at $85,000. W. H. Williams, of Preston, is manager.

WATKINS, MINN.—A franchise has been granted to the Lethert El. Co., of St. Paul, to install an electric-light plant here.

GULFPORT, MISS.—The substation of the Gulfport & Mississippi Coast Trac. Co. at Pass Christian was recently destroyed by fire.

VICKSBURG, MISS.—Work has begun on excavations for the construction of a new power house in Vicksburg.

FREDERICKSBURG, MO.—At an election held Aug. 31 the proposition to issue $12,000 for construction of a municipal electric-light plant was carried.

KANSAS CITY, MO.—Steps have been taken by the South Side Improvement Association for the installation of ornamental street lamps on South Main treet and East Thirty-first Street. The City Council is considering an ordinance granting permission for placing ornamental street lamps on trolley poles on Thirty-first Street from Main Street to Troost Avenue and on Main Street from Twenty-seventh Street to Westport Avenue. The association asks that the city furnish energy for maintaining the lamps.

LAWSON, MO.—The Excelsior Springs Wtr., Gas & El. Co. has applied to the City Council for a franchise to operate in Lawson. S. W. Henderson, Excelsior Springs, is vice-president of the company.

NEVADA, MO.—The property of the Nevada Wtr., Lt. & Trac. Co., consisting of water, gas and electric plants and street-railway system, has been purchased by W. C. Gunn, of Fort Scott, Kan. The properties have been taken over by the Fort Scott & Nevada Trac. Co, and it is understood that the plants in the two cities will be operated in conjunction with each other.

HARDIN, MONT.—The Big Horn Canyon Co. is planning to build a dam across the Big Horn River for power development and irrigation purposes.

GENOA, NEB.—Plans are being considered by the power canal company for the construction of a power house in Genoa.

NORFOLK, NEB.—The installation of an ornamental street-lighting system on Norfolk Avenue is under consideration by the Commercial Club.

TILDEN, NEB.—The Board of Town Trustees has awarded a contract to the Norfolk El. Lt. & Powr. Co. for lighting the streets of the town for a period of ten years. The contract calls for 43 50-watt tungsten lamps.

TRENTON, N. J.—The Trenton & Mercer County Trac. Corpn. is building an addition to its power house. A 1500-kw De Laval turbo-generator set will be installed.

ALBANY, N. Y.—Notice is hereby given that the time for returning bids for incandescent lamps, which it was advertised would be received at the office of the purchasing committee for state hospitals, Room 138, Capitol, Albany, until Sept. 12, is changed to Sept. 24. All bids received to be opened on the 12th will therefore remain unopened and may be withdrawn and filed again on the 24th if so desired.

ANTWERP, N. Y.—The Village Board of Trustees has granted the Northern Pwr. Co., of Potsdam, a franchise to supply electricity here. If approval of the franchise is secured from the Public Service Commission work on securing right of way and locating route for transmission line from Gouverneur to Antwerp will begin at once. Work on erection of the line will begin early in the spring. The village has entered into a contract with the company for street lighting for a period of five years. K. J. Snell, Potsdam, is manager of the company.

BINGHAMTON, N. Y.—Plans are being considered by the property owners and others for the installation of ornamental street lamps along the river front on Wall Street.

BINGHAMTON, N. Y.—Plans are being considered by the City Council for the construction of a municipal electric-light plant. Available sites are now being investigated by the Council. J. A. Giles is city engineer.

CHERRY VALLEY, N. Y.—The citizens have voted to have the streets of the village lighted by electricity, the service to be furnished by the Montgomery El. Lt. & Pwr. Co., of Canajoharie.

CHILI, N. Y.—The Rochester Ry. & Lt. Co. has been granted a franchise by the town of Chili to supply electricity for lamps and motors in the Elmwood tract.

FULTON, N. Y.—The Baker El. Co. has submitted a proposition to the Board of Public Works for the installation of ornamental lamps in three more streets. The lamps will be similar to those in Oneida Street.

NEW YORK, N. Y.—The contract for installing electrical equipment in the first portion of the new Normal School buildings, Thomas Hunter Hall, has been awarded to the Commercial Constr. Co., 24 State Street, New York, at $19,777. C. B. J. Snyder is superintendent of school buildings.

NEW YORK, N. Y.—The New York Rys. Co. has applied to the Public Service Commission for permission to issue $2,600,000 in bonds for the purpose of acquiring new equipment and improving its property. The company proposes to purchase 320 stepless cars at a cost of $1,600,000 and to add two stories to its power house at Fifty-fourth Street and Ninth Avenue, at a cost of about $550,000. The commission has also approved the plans for the proposed extension of the 116th Street crosstown line from Pleasant Avenue to the East River.

OLEAN, N. Y.—Extensive improvements are contemplated by the Olean El. Lt. & Pwr. Co., involving an expenditure of $250,000. Work has commenced on the new power house, which is the first step toward the extension. Frederic B. Hofft has been appointed general superintendent.

UTICA, N. Y.—The Adirondack El. Pwr. Co. has secured a permit to remodel its power house on the Mohawk River Flats at a cost of about $7,500. The change will be made so as to enable the company to connect with the lines of the Utica Gas & El. Co.

DURHAM, N. C.—Application has been made to the State Department by Benjamin N. Duke, George and Buchanan Lyon and Jone Fuller for a charter to operate an electric-light plant and electric street railway in Durham. The company will be known as the Durham Pwr. Co. and will be capitalized at $750,000.

VADE MECUM, N. C.—Plans are being considered by Cicero Tise for the installation of a hydroelectric power plant to supply electricity for lamps and motors for Vade Mecum Springs.

BELFIELD, N. D.—The installation of an electric-light plant here is under consideration. T. Lerfald, of Anoka, Minn., is interested.

GRAND FORKS, N. D.—The Water and Light Commission has decided to erect a new electric-light plant, for which bids have been asked. It will be located on the site of the present building and will be equipped with new machinery. It is expected that the Red River Pwr. Co., which furnishes energy for the local system, will install a dynamo in the new structure, so as to do away with the large cables now erected across the river.

MINOT, N. D.—The installation of an ornamental street-lighting system in Minot is under consideration.

CINCINNATI, OHIO.—Bids will be received until Oct. 8 by the Board of Hospital Commissioners of the city of Cincinnati for furnishing labor and material required in the completion and equipment of the 18 buildings composing the main group of the new General Hospital as follows: (1) Laundry machinery; (2) kitchen equipment; (3) refrigerating plant and cold-storage rooms; (4) water-tube boilers and stokers; (5) steam engines; (6) generators and switchboard, (7) main feeders, electric wiring and ground lighting; (8) radial brick chimney; (9) main gas supply; (10) sterilizing and disinfecting equipment; (11) electric-lighting fixtures; (12) direct-lift plunger elevator. Plans and specifications are on file at the office of the Board of Hospital Commissioners, Burnet Avenue, Cincinnati, and at the office of Samuel Hannaford & Sons, architects, Hulbert Block, Cincinnati. Henry T. Hunt is president of board.

CLEVELAND, OHIO.—A permit has been secured by the Cleveland Ry. Co. to erect a power substation and a battery station at 3880 West Twenty-fifth Street. The cost of the substation is estimated at $30,000 and that of the battery station at $11,500.

CLEVELAND, OHIO.—The Sinking Fund Commission, it is reported, has agreed to purchase municipal bonds to the amount of $500,000, authorized at the last municipal election for the purpose of making extensions to the municipal electric generating plant. A new power station costing $200,000 will be erected and will be equipped with three 5000-kw steam turbines. Improvements will also be made to the present generating stations and substations.

FOSTORIA, OHIO.—The Public Service Commission has approved the sale of the electric light and power plant of the Standard Lt. & Pwr. Co., of Fostoria, to Field W. Swezey. The price paid for the property is said to be $82,000.

LIMA, OHIO.—The Board of Education has decided to install an electric-light plant in the manual-training department of the high-school building. A gas engine is already installed in the building and it is proposed to purchase a generator.

SANDUSKY, OHIO.—The City Council has authorized the director of public service to advertise for bids for street lighting beginning Jan. 1, 1914. Bids will be asked for two, five and ten years.

SPRINGFIELD, OHIO.—The contract for installing 112 cluster lamps in Snyder Park has been awarded to the Sackett Mine Supply Co., of Springfield.

TEXHOMA, OKLA.—The construction of light, water and ice plant, to cost about $40,000, is contemplated by J. W. McRea, of Amarillo, Tex., and associates.

ORENCO, ORE.—Work will soon begin on the construction of the proposed electric railway between Helvetia and Orenco. J. H. Young, president of the Oregon El. Ry. Co., and others are interested in the project.

PORTLAND, ORE.—George F. Huesner has been granted a franchise to construct and operate an electric railway from the northerly boundary of Portland across the Broadway Bridge up Seventh Street and on into South Portland.

SALEM, ORE.—The Southern Pacific Co. has purchased the electric railway which runs from Willamette to Bolton and will extend it from Bolton to Salem.

STAYTON, ORE.—Work will soon begin on construction of an electric railway from Salem to Stayton, a distance of 18 miles, for which right-of-way has been secured. J. P. Mounce is interested in the project.

SUTHERLIN, ORE.—F. B. Waites, of Sutherlin, is interested in a project to construct an electric railway to connect Coos Bay and Sutherlin.

PANAMA.—Plans are being prepared for the construction of two floating pumping plants, one to be used at the Gatun locks, Panama Canal, and the other at the Pedro Miguel and Miraflores locks, as auxiliaries to the pumping plants which will be installed in the lock caissons for unwatering the various sumps. Each plant will consist of four motor-driven 20-in. centrifugal pumps or their equivalent, for operation under heads from 5 ft. to 50 ft. at Gatun and Pedro Miguel and from 5 ft. to 70 ft. at Miraflores, mounted on one or two barges.

ELIZABETHTOWN, PA.—The property of the Elizabeth & Marietta El. Co., including power plant and distributing system in Elizabethtown and distributing systems in Rheems, Florin, Maytown, Mount Joy and adjacent territory, was sold at receivers' sale to John A. Coyle, of Lancaster, for $60,500.

EPHRATA, PA.—The stockholders of the Ephrata & Lebanon El. Ry. Co. have authorized an issue of $250,000 in bonds, the proceeds to be used to complete the railway between Lebanon and Ephrata.

HARRISBURG, PA.—Announcement has been made that Olmsted & Stamm will apply to the State Department on Sept. 23 for a charter for the Capital Ht. & Pwr. Co. The company proposes to supply electricity for lamps, heat and motors in Harrisburg.

LANCASTER, PA.—The property of the Southern, Oxford & Southern R.R. Co. has been purchased by F. R. Williams, representing interests allied with the Conowingo Pwr. Co., for $52,000. Plans have been perfected by the power company for building a dam on the Susquehanna and construction of a hydroelectric plant. It is expected that the railroad will be equipped for electrical operation.

MEYERSDALE, PA.—The City Council has granted the Meyersdale El. Lt., Ht. & Pwr. Co. a 10-year franchise to supply electricity in Meyersdale. The Council has also awarded the company a five-year contract for street lighting under the terms of which the arc lamps now in use will be replaced with new magnetite arc lamps.

PITTSBURGH, PA.—Extensive improvements to the equipment of the Pittsburgh-Butler Street Ry. Co. and the Butler County Lt. Co. are under way. Arrangements are being made by the traction company to change the equipment of its line so as to utilize 1200-volt direct current instead of the single-phase current now used. Plans are also being made to establish nine substations along the transmission line between this city and Butler for the purpose of supplying electricity for lamps and motors. Charters recently have been granted to nine light and power companies in towns along the line, all subsidiaries of the Butler company. The transmission line is 33 miles in length and surveys have been made for an extension to East Butler. The main power plant is located at Renfrew, and has an output of about 4000 kw, of which about half is being used at present. Locations have been selected for two of the substations. Electricity will be transmitted to the substations at 22,000 volts. The contract for equipping the substations and the cars has been awarded to the General El. Co. James Bryan, Park Building, Pittsburgh, is consulting engineer.

POLK, PA.—Chester & Fleming, hydraulic engineers, of Pittsburgh, have been authorized to prepare plans and specifications for a 1,000,000-gal. electrically operated pumping station for the water supply of the State Institution of the Feeble-Minded at Polk. Proposals for this work will soon be asked for.

NEWPORT, R. I.—Sealed bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 28 for furnishing and installing complete with all accessories at the naval station, Newport, R. I., one 120-hp and one 220-hp fuel-oil engines with one 94-kw generator and one 175-kw generator; also to remove, remodel and reinstall one 160-kw generating unit driven by Busch-Sulzer Brothers Diesel engine. The cost of the work is estimated at $38,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. William M. Smith is acting chief of bureau.

NEWPORT, R. I.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 28 for four centrifugal pumps, two being motor-driven fire pumps of 1000 gal. per minute capacity at 230-ft. and 115-ft. head, and two steam-turbine-driven hot-water pumps of 500 gal. per minute capacity at 159-ft. head, all delivered and installed on foundations provided by the government at the naval torpedo station, Newport, R. I. Cost of the work is estimated at $7,500. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. William M. Smith is acting chief of bureau.

NEWPORT, R. I.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 5 for furnishing and installing at the naval station, Newport, R. I., a complete power-plant piping system to connect 1000-hp boilers, 700-kw engines, fire pumps, forced-circulation hot-water heating system pumps and heaters, boiler-feed pumps, feed-water heaters and meters, separators, traps, special valves, feed-water governors and regulators, etc., to be furnished by the government, and to furnish and install all additional necessary accessories. Cost of work is estimated at $9,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. William M. Smith is acting chief of bureau.

CHERAW, S. C.—Sealed proposals will be received by the Public Works Commission until Sept. 17 for construction of water-works and a sewerage system. The water-works will include electrically operated pumping station, tower, tank, reservoir and auxiliary electrically operated pumping station. Plans and specifications are on file at the office of William Godfrey, chairman Public Works Commission, Cheraw, and at office of Gilbert C. White, engineer, Charlotte, N. C.

COLUMBIA, S. C.—The Parr Shoals Pwr. Co. has been granted permission to increase its capital stock from $100,000 to $2,300,000. Edwin W. Robertson, G. K. Dustin and William Elliott are among the directors.

FAIRVIEW, S. D.—Preparations are being made for the construction of a concrete dam across the Big Sioux River at Fairview. Power developed by the dam will be utilized to generate electricity which will be transmitted to towns and cities in this vicinity. Arthur Lattimer, of Eldora, Ia., has the contract for construction of the dam.

HUMBOLDT, S. D.—The Hartford El. Lt. & Tel. Co., of Hartford, has submitted a proposition to the City Council offering to extend its transmission line to Humboldt and supply electricity for lighting the streets, business places and residences.

CHATTANOOGA, TENN.—Arrangements have been made by C. E. James, who is building an electric railway up Walden's Ridge, for electricity from the Ocoee plant until the Hale's bar lock and dam is completed.

PERYEAR, TENN.—The city of Peryear is installing an electric-light plant and water-works system.

AMARILLO, TEX.—Work has begun on the installation of an electric-light plant to supply electricity for lighting the yards, roundhouses, machine shops and station of the Santa Fé system in Amarillo.

CORPUS CHRISTI, TEX.—The Corpus Christi St. & Interurban Ry. Co. is planning to construct a power plant, the equipment to include a 150-kw generator, 240-hp engine and 200-hp boiler. Machinery has not been purchased. The company has applied to the City Council for a franchise to supply electricity for lamps and motors here. E. C. Heinley is vice-president of the company.

DALLAS, TEX.—Work will soon begin on the survey of the proposed electric railway between Dallas and Austin to be built by the Trinity Valley Trac. Co. The railway will be 235 miles long and will pass through Hubbard, Marlin, Temple and Georgetown.

FORT WORTH, TEX.—The Fort Worth Pwr. & Lt. Co. is planning to extend its transmission lines to Niles City.

HILLSBORO, TEX.—Bids will be received until Sept. 26 by A. W. Young, secretary of the school board, for wiring a 16-room school building. Bids will be taken separately or with general contract.

HILLSBORO, TEX.—It is reported that the interurban railway which extends from Dallas to Cleburne will be extended to Hillsboro, a distance of about 35 miles. Surveys have been made and work will begin as soon as the right-of-way is secured and other details arranged. The Stone & Webster Engineering Corpn., Boston, Mass., will build the road.

HOUSTON, TEX.—The County Commissioners have granted the Houston El. Co. a franchise to construct an electric railway on Fifteenth Street and Navigation Boulevard, in Central Park and Avenue M in Magnolia Park.

WEST, TEX.—Application has been made by the Southern Trac. Co. for a franchise to construct an electric light and power plant in West.

SALT LAKE CITY, UTAH.—Surveys are now being made by the Utah Lt. & Ry. Co. for an extension of the North Salt Lake line to Bountiful, a distance of 8 miles.

TOOELE, UTAH.—Work has commenced on the construction of a new hydroelectric power plant for the Clarke El. Pwr. Co., Tooele, to be erected at South Willow, 6 miles from Grantsville. Water for operating the plant will be carried through a new pipe line 4 miles long and from 16 to 20 in. in diameter. Electricity will be transmitted at 11,000 volts to the Ophir Hill Consolidated Mining property and connect with the Clark company's line at Stockton. The cost of the plant is estimated at $75,000. E. W. Clarke, of Ophir, is president and manager and C. E. Green is superintendent.

STAUNTON, VA.—The City Council is contemplating building an entire new municipal electric plant instead of making improvements to the present plant.

VESUVIUS, VA.—Plans are being considered by the Vesuvius Plow Works for the installation of a small electric-light plant to be operated by water-power.

ARLINGTON, WASH.—The South Fork Tel. Co., recently organized, is planning to install a telephone system in Arlington.

BREMERTON, WASH.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 5 for electric wiring and fixtures in new general foundry building at the navy yard, Puget Sound, Wash. Cost of the work is estimated at $2,000. William M. Smith is acting chief of bureau.

CAMAS, WASH.—The Northwest El. & Pwr. Co. contemplates the erection of a substation in Camas.

KIRKLAND, WASH.—Plans are being considered by the Kirkland Lt. & Pwr. Co. for the construction of a power house here. Equipment for the power plant has been purchased.

LYMAN, WASH.—The Pacific Northwest Trac. Co., Seattle, has applied for a franchise to install and operate an electric-light system in Lyman.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. has asked for permission to make extensions to its Kinnear Park line. Jacob Furth is president.

SHELTON, WASH.—The Hartline Tel. Co. has applied to the County Commissioners for permission to erect a telephone system.

TACOMA, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. will soon begin work on the extension of its lines from the county poor farm, near Sumner, to Alderton.

VANCOUVER, WASH.—The Washington Ry., Lt. & Pwr. Co. is planning to erect a substation, 50 ft. x 200 ft., at the foot of Washington Street, Vancouver.

NICOLETTE, W. VA.—The charter of the Breining Mfg. Co., recently incorporated, gives it the privilege of generating and selling elec-

tricity. The company is capitalized at $30,000. Among the incorporators are: H. L. Breining, Millard W. Neff and W. Scott Radeker, all of Parkersburg.

PRINCETON, W. VA.—The property of the Princeton Pwr. Co. has been purchased by the Appalachian Pwr. Co. for $85,000.

BOSCOBEL, WIS.—The Lancaster El. Lt. Co., Lancaster, has submitted a proposition to the Council offering to supply electricity to operate the municipal electric-light plant. A committee has been appointed to investigate the matter.

COLUMBUS, WIS.—Plans are being considered by the water and light commission for enlarging the municipal lighting system, installing electroliers, etc.

KILBOURNE, WIS.—Plans are being prepared by the Southern Wisconsin Pwr. Co., Madison, for enlarging its hydroelectric power plant, located near Kilbourne.

MENASHA, WIS.—The City Council contemplates replacing the present street arc lamps with arc lamps of modern design.

MILWAUKEE, WIS.—The Milwaukee El. Ry. & Lt. Co. is planning to extend its line on Forty-eighth Street from Pabst Avenue to North Avenue. R. B. Stearn is assistant general manager.

NEENAH, WIS.—Arrangements are being made by the Bergstrom Paper Co. for the construction of a large hydroelectric power plant near the paper mill.

NEW HOLSTEIN, WIS.—The contract for installing an electric-light plant for the village has been awarded to the Acker Elcl. Co., of Sheboygan, to cost about $15,000.

SHAWANO, WIS.—Bids will be received by the building committee for the Shawano County Asylum until Sept. 18 for furnishing and installing complete one 50-kw generator and 80-hp engine, according to plans and specifications on file at the office of the committee and F. W. Dodge Co., 842 Monadnock Bldg., Chicago, Ill. C. F. Lueke is chairman of the committee.

WAUWATOSA, WIS.—The contract for construction of a power house at the Asylum for Chronic Insane, Wauwatosa, has been awarded to the Appleton Constr. Co. at $12,889.

WAUWATOSA, WIS.—Plans have been prepared by James N. Alear, consulting engineer, Chicago, Ill., for the installation of a central heating and power plant for the county institutions at Wauwatosa, to cost approximately $494,550.

EDMONTON, ALTA., CAN.—The Municipal Council will submit several by-laws to the ratepayers on Sept. 23, one of which will provide for an appropriation of $21,900 for a telephone substation in the Hudson Bay reserve.

MEDICINE HAT, ALTA., CAN.—A bill asking for an appropriation for the installation of an automatic telephone system in this city will be submitted at the next session of the Legislature.

MERRITT, B. C., CAN.—It is reported that bids are being asked by Dutcher, Maxwell & Co., engineers, of Vancouver, B. C., for furnishing material and construction of an electric light and power station in Merritt.

NEW WESTMINSTER, B. C., CAN.—Plans are being considered for the installation of police and fire-alarm systems.

VANCOUVER, B. C., CAN.—Bloedel, Stewart & Welch, Ltd., it is stated, will petition the provincial government for permission to develop a water-power on the Cheakamus River, a few miles south of Green Lake, to cost approximately $2,000,000.

VANCOUVER, B. C., CAN.—The Western Canada Pwr. Co. is reported to have entered into a contract with the British Columbia El. Ry. Co. to supply it with 40,000 hp. It is expected that the power company will enlarge its plant to enable it to fill the contract. C. H. Cahan, of Montreal, Que., is president of the Western Canada Pwr. Co.

GALT, ONT. CAN.—Negotiations are under way between the Grand Valley Ry. Co. and the Hydro-Electric Department of the town of Galt, whereby the latter is to supply electricity for operating the cars of the former from Galt to Paris. It is estimated that 200 hp will be required.

INGERSOLL, ONT., CAN.—Several of the farmers of North and West Oxford Townships have applied to the Hydro-Electric Commission for electrical service.

MILTON, ONT., CAN.—The Hydro-Electric Commission has decided to extend its transmission lines from Brampton to Milton. The extension will be about 13 miles long and will cost about $26,000.

TORONTO, ONT., CAN.—The Hydro-Electric Commission is contemplating further extensions in the eastern district. The town of Russell has asked the commission to submit estimates on 750 hp, 1000 hp and 1500 hp. The municipality of Smith Falls also contemplates entering into a contract with the commission for electricity.

WELLAND, ONT., CAN.—The ratepayers, of Crowland Township, have granted the Canadian General Securities Co., of Toronto, permission to lay cables, gas mains and water pipes in the section known as Welland South.

MONTREAL, QUE., CAN.—The stockholders of the Shawinigan Wtr. & Pwr. Co. have ratified an issue of $5,000,000 in new capital stock, of which the directors have decided to issue $1,500,000 to the stockholders at $120 per share.

CANORA, SASK., CAN.—The ratepayers have voted in favor of the by-law appropriating $20,000 for the installation of a municipal electric-light plant.

KINDERSLEY, SASK., CAN.—The ratepayers have voted in favor of the by-law providing for the installation of an electric-light plant and water-works system to cost $90,000.

SAN LUIS POTOSI, MEX.—D. J. Spillane, of San Luis Potosi, who recently obtained a concession from the federal government to install a large hydroelectric power plant at the junction of the Maria and Gallinas Rivers in this State, has organized a company in the United States to carry out the project. It is estimated that 40,000 hp can be developed at the proposed site of the hydroelectric plant. Surveys have also been made for proposed water-storage reservoirs in that section by which the available power may be increased to 100,000 hp. Transmission lines will be erected to the cities of San Luis Potosi, Tampico, Saltillo, Metahuala and a number of other towns and industrial centers.

New Industrial Companies

THE BRADY ELECTRIC & MANUFACTURING COMPANY, of New Britain, Conn., has been incorporated by William J. Noble, N. J. Brady, William P. Brady and Fred M. Brady, all of New Britain. The Company is capitalized at $15,000.

THE COLONIAL ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Bird Malvin Grayville, Samuel J. Shaeffer and Morris Kempel.

THE ELECTRIC DISPLAY COMPANY, of Los Angeles, Cal., has been granted a charter with a capital stock of $10,000. The incorporators are: L. A. Hitchcock, J. B. Pendleton and W. and H. Oates.

THE HARRISON ELECTRIC COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Edward F. Quirke, John S. Quirke and R. M. Quirke.

THE ILLUMINATING COMPANY, of Paterson, N. J., has been incorporated by W. H. Wiley, Joseph E. Allen and A. L. Feidberg. The company is capitalized at $125,000 and proposes to manufacture display letters.

THE SALVINI ELECTRICAL HORN MANUFACTURING COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $50,000. The incorporators are: Edward Salomon, Godfrey S. Salomon and Salvatore Salvini.

THE SANTO ELECTRICAL APPLIANCE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $15,000 by Charles Groshut, Florence Groshut, Herbert A. Durbrow and Alfred F. Durbrow.

THE SOUTHERN ELECTRIC EQUIPMENT COMPANY, of Columbus, Ohio, has been incorporated with a capital stock of $75,000 by W. F. Felton, H. C. Mayers, F. L. Ferguson, N. Patterson and D. N. Postlewaite. The company proposes to manufacture electrical laundry machinery and to purchase, operate and equip laundries with electrical supplies and machinery.

THE WERN MACHINERY & ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 to do general contracting work, etc., by G. P. Wern, Algot E. Sylvan, W. C. Wern, all of 96 Hamilton Place, New York.

New Incorporations

CANTON, ILL.—The Central & Western Illinois Trac. Co. has been incorporated by J. T. Adams, Columbus, Ohio; C. P. Williams, Chicago, Ill.; A. L. Ralson, Grove City, Ohio; W. R. Curran, Pekin, Ill.; L. H. Ash, Canton, Ill., and others. The company is capitalized at $200,000 and proposes to construct and operate a railway from Pekin to Peoria, Ill., through the counties of Tazewell, Peoria, Fulton, McDonough and Hancock to Hamilton, and thence to Keokuk, Ia.

CHICAGO, ILL.—The Union Central El. Co. has been chartered with a capital stock of $5,000 to generate and sell electricity. The incorporators are: William H. C. Weston, Guy E. Summers and Noble B. Judah, Jr.

SPRINGFIELD, ILL.—The Springfield Clear Lake & Southern Ry. Co. has been incorporated with a capital stock of $2,500 to take over the Springfield, Clear Lake & Rochester Interurban Ry. It is planned to secure the property by foreclosure, to improve the road and build a branch line to Riverton. The incorporators are: Dr. N. R. Gordon, A. W. Sikking, W. R. Thompson, H. L. Metcalf, of Springfield, and W G. Brown, of Rochester.

ELDORA, IA.—The Iowa River Lt. & Pwr. Co. has been incorporated with a capital stock of $300,000 to develop the water rights on the Iowa River for power purposes. The incorporators are. E. H. Lundy, G. W. Wood, E. R. Baskerville, A. H. Latimer and J. G. Hartenberg.

HUDSON FALLS, N. Y.—The Lake George Highway Ltg. Co. has been chartered with a capital stock of $5,000. The incorporators are Charles T. Peabody, John Peterson and Elias Taylor, all of Lake George.

NEW YORK, N. Y.—The Metropolitan Tel. & Teleg. Co. has been incorporated with a capital stock of $10,000 to operate telephone and telegraph lines from 135 East Sixteenth Street, borough of Manhattan, to points in Long Island and New Jersey. The incorporators are: H. Lee Sellers, R. H. Sellers, C. A. Aver, Butler Jack, L. Lemon, W. H. McCollum and H. T. Haskell

PORTLAND, ORE.—The Hurley Hydraulic Transmission Co. has been incorporated with a capital stock of $50,000 by W. J. Binns, J. H. Hurley and A. Sweek.

SENECA, S. C.—The Conneross Lt. & Pwr. Co. has been incorporated with a capital stock of $100,000 by G. W. Gagnilliat, L. A. Edwards, of Seneca, and Campbell Courtenay, of Newry, S. C.

HOWARD, TEX.—The Howard Wtr. & Lt. Co. has been chartered with a capital stock of $5,000 by J. T. Murphey, W. R. Woods, J. S. Robinson and others. Post office address Howard, R.F.D. Waxhachie.

COVINGTON, VA.—The Covington Lt. & Power Co. has been incorporated with a capital stock of $100,000. The company proposes to supply electricity in Covington, Clifton Forge and Alleghany, Bath, Botetourt and Craig Counties. The officers are: John S. Ham, president; W. A. Rinehart, vice-president, and M. S. Noffsinger, secretary and treasurer.

ROANOKE, VA.—The Roanoke Utilities Corpn. has been granted a charter with a capital stock of $25,000. The officers are: E. M. Funkhouser, president; J. W. Fishburne, vice-president, and H. C. Elliott, secretary.

TACOMA, WASH.—The Washington El. Ry. Co. has been incorporated with a capital stock of $1,000,000 for the purpose of building an electric railway between Tacoma and Vancouver on the Columbia River. Branch lines will also be built through Tenino, Raymond, South Bend, Aberdeen, Hoquiam and Randle. It is understood that Welsh interests controlling the Washington-Oregon Corporations are interested in the new company.

LESTER, W. VA.—The Lester Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 to construct and operate water and electrical plants and operate an electric-car line. The incorporators are: E. M. Canady, J. Levi Cook, J. B. Canady, J. Q. Brooke and G. Y. Kelley, Lester, and James Bryson, Bryson.

Trade Publications

DIRECT-CURRENT RAILROAD.—Buletin No. 4950 of the General Electric Company gives a comprehensive account of the Washington, Baltimore & Annapolis 1200-volt direct-current railroad.

REVOLVING-FIELD ALTERNATORS.—The Fort Wayne Electric Works of the General Electric Company have issued Bulletin No. 1137, which refers to belt-driven revolving-field polyphase alternators.

VOLT-AMMETER.—A railway signal volt-ammeter is illustrated and described in Bulletin No. 4880 of the General Electric Company. This instrument is used for testing direct-current railway-signal apparatus.

WATER STRAINERS—Practical information on the installation and operation of water strainers for power-plant purposes is given in an eight-page folder issued by the Lagonda Manufacturing Company, Springfield, Ohio.

DISTRIBUTION TRANSFORMERS.—Bulletin No. 151 of the Crocker-Wheeler Company, Ampere, N. J., gives information on the Remek distributing transformer, for which type a very low average core loss is claimed.

ORNAMENTAL LAMP-POSTS.—The Morris Iron Company, Frederick, Md., has issued a new bulletin, size 9 in. by 3¾ in., illustrating eighteen different designs of ornamental lampposts and brackets. Many of these designs show lines of beauty as well as utility.

MOTORS.—Bulletin No. 141 of the Crocker-Wheeler Company, Ampere, N. J., refers to alternating-current motors of the induction type designed for operating from 25-cycle polyphase circuits. It briefly describes and generously illustrates this class of apparatus.

INDUSTRIAL RAILWAYS.—The C. W. Hunt Company, West New Brighton, N. Y., is mailing a stretcher, 20 in. long when unfolded, on its industrial railway system. Many illustrations showing the system in operation accompanied by terse paragraphs make up the circular.

AMMETERS.—Messrs. Everett, Edgcumbe & Company, Ltd., London, England, have distributed a fac-simile of an ammeter of ordinary size, with the dial printed on it, and in the center is an opening which permits of the adjustment from month to month of a perpetual calendar.

BALL BEARINGS.—The Hess-Bright Manufacturing Company, Philadelphia, Pa., has issued in loose-leaf form a series of sheets illustrating the application of ball bearings to various kinds of apparatus, each sheet referring to a class of machinery in which ball bearings have been employed.

MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., in its Bulletin No. 3221 gives information concerning its bipolar ventilated motors. These motors are made in five sizes of frames, ranging from 0.05 hp to 0.25 hp. The bulletin contains data, dimensions, code words, prices and illustrations.

REFLECTORS.—An eight-page folder has recently been issued by the Haskins Glass Company, Wheeling, W. Va., in which the Haskins-Lucida diffusive reflectors are illustrated. Among the types of reflectors shown are the semi-flared, flat, mission-bell and bowl types, and also two styles of pendent reflectors.

LAMPS.—In a twelve-page pamphlet issued by the Straight Filament Lamp Company, 125 West Forty-second Street, New York, information is given concerning the "rayline lamp." It consists of a straight filament in a clear glass tube 12 in. long. It is constructed to withstand hard usage and is said to give shadowless light.

GENERATORS.—Instruction book No. 3053 of the Fort Wayne Electric Works of General Electric Company deals with multiphase revolving-field alternating-current generators and belted exciters. It gives much general information for the users of this class of apparatus and contains eight pages of diagrams of connections and wiring.

MOTOR VEHICLES.—A preliminary catalog of motor vehicles is being issued by the Duryea Motor Company, Saginaw, Mich. Motor-driven buggies form the subject of the pamphlet. An introduction on the development of this class of vehicle, illustrations, specifications and brief descriptions go to make up the contents.

SEWING MACHINE MOTORS.—Bulletin No. 3912 of the Emerson Electric Manufacturing Company, St. Louis, Mo., is devoted to information with respect to factory sewing-machine motors. The factory motor outfits described in the bulletin consist of motors furnished complete with all necessary rods, screws, transmitters, etc.

INSTRUMENTS.—Bulletin No. 62 of the Industrial Instrument Company, Foxboro, Mass., illustrates and describes stationary tachometers and tachographs, covering a great variety of styles, ranges and purposes for practically all kinds of industrial and engineering service. Information concerning precision instruments is also included.

PORTABLE LAMPS.—In a booklet recently issued by the Phoenix Glass Company, Pittsburgh, Pa., illustrations and brief descriptions are given of a handsome line of portable lamps for household use. The colorings include the Adam decoration, which is similar to old alabaster, and the Nile decoration, which is of soft, velvety pale green.

MOTOR DRIVE IN RAILROAD SHOPS.—"The Electrical Operation of Railroad Shops" is the title of Bulletin No. 4959, recently issued by the General Electric Company. The bulletin shows the advantages of individual drive over group drive and gives an illustrated description of installations in some of the important railroad shops in the country.

STREET LIGHTING.—The series incandescent street-lighting system is the subject of Bulletin No. 4952 issued by the General Electric Company. The pamphlet contains considerable descriptive information with illustrations relating to incandescent street lighting. Bulletin No. 4951 takes up the same subject with reference to lighting with tungsten lamps.

ARC RECTIFIER OUTFIT.—The General Electric Company's Bulletin No. 4925 describes its combined unit mercury-arc rectifier outfit in considerable detail. This equipment consists of the constant-current transformer, direct-current reactance, tube tank and exciting transformer mounted on a common base. Dimension and connection diagrams are included.

ELECTRIC SPECIALTIES.—The G & W Electric Specialty Company, 6408 Jackson Park Avenue, Chicago, Ill., in its Catalog No. 7, follows the first page of explanatory definitions of its specialties with a general description of them and gives many half-tone illustrations and diagrams showing its pot-heads in actual installation. It contains also other matter of interest to central-station men.

ROOFING.—"A Mile of Barrett Specification Roofs—and What the Owners Write About Them" is the title of a publication issued by the Barrett Manufacturing Company, 17 Battery Place, New York. It consists of two pages of reading matter and a triple-page photograph showing the Bush Terminal Buildings, Brooklyn, all of which are covered with Barrett specification roofing.

INTERIOR TELEPHONES.—Catalog No. 22 of the Connecticut Telephone & Electric Company, Meriden, Conn., deals with intercommunicating telephone systems for interior use. Single-point, multiple, apartment-house, "centerphone" or school, hotel-annunciator and switchboard systems are described in this catalog, which also gives illustrations and diagrams of these systems and various telephone accessories.

DIRECT-CURRENT MOTORS.—Bulletin No. 149 has been issued by the Crocker-Wheeler Company, Ampere, N. J. It deals with Form H direct-current motors and generators of 50 hp and larger. This line of motor replaces the C-W form D direct-current machines of the pedestal type and, it is claimed, has the advantage of being more compact and therefore better adapted for application to machinery of all kinds.

INDUCTION MOTORS.—Single-phase repulsion induction motors rated at from 0.25 hp to 15 hp are made the subject of Bulletin No. 1140 of the Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind. It is stated that this motor possesses high efficiency, high power-factor, high starting torque, large overload range and mechanical simplicity. The bulletin contains illustrations, diagrams and a general description of the apparatus.

ELECTRIC TRUCKS.—The electric division of the General Motors Truck Company, Detroit, Mich., has issued a forty-eight-page booklet on the electric truck, a sketch indicating the development and present status of this modern successor to the horse. For the prospective purchaser of electric trucks the booklet contains definite, practical information as to cost, operation and maintenance and the experience of others who have installed electric trucks. Central-station men will be especially interested in this little story.

Business Notes

THE AMERICAN CARBON & BATTERY COMPANY, St. Louis, Mo., has announced the opening of its new factory, built to replace the one destroyed by fire Dec. 27, 1911.

THE ATWATER KENT MANUFACTURING COMPANY has moved its offices and plant for manufacturing electrical instruments from 46 North Sixth Street, Philadelphia, to 4937 Stenton Avenue, Germantown.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has prepared for distribution to its electrical supply customers a celluloid tablet arranged for the rapid determination of net profits and discounts. The device should prove especially useful to supply dealers and contractors.

THE INTERSTATE ELECTRIC COMPANY, of 443 South Dearborn Street, Chicago, engineer and contractor for electrical installations, is about to open an office in Indianapolis. The company makes a specialty of water-power construction and carries a stock of electrical supplies.

WALTER B. SNOW, publicity engineer, Boston, Mass., has added to his staff Mr. Chester R. Ross, who will act as manager of the addressing and mailing department. Among the recent publications issued is a neat booklet entitled "Publicity Engineering," which is defined as a combination of practical engineering knowledge and advertising experience for the creation of productive publicity regarding technical matters.

INDEPENDENT ELECTRIC MANUFACTURING COMPANY.—A new factory building is being erected at Milwaukee by the Independent Electric Manufacturing Company, builder of motor controllers, starters and accessories. The new structure is of concrete faced with brick and will be equipped with individual motor drive and all modern equipment. After taking possession of its enlarged quarters, the company plans to extend its lines of manufacture of control apparatus.

BROWN, HOPKINS, NISSEN & SPRINKLE is the new name under which the firm of Brown & Hopkins, patent attorneys, 1124 Monadnock Block, Chicago, will continue the practice of patent and trade-mark law. Mr. Charles M. Nissen, who will become a member of the new firm, is a member of the bar, was graduated in electrical engineering from the Case School of Applied Science and from George Washington University, was an assistant examiner in the United States Patent Office for about five years, then had charge of the patent department of the Otis Elevator Company for a few years, and has been associated with Brown & Hopkins in the practice of patent and trade-mark law for several years past. Mr. Arthur L. Sprinkle, who will become a member of the new firm, was for a number of years connected with the patent department of the Warder, Bushnell & Glessner Company and the experimental department of the International Harvester Company. He is a graduate of the Chicago-Kent College of Law, of Austin College and of Rochester Business University, is a member of the Illinois bar and has been associated with Brown & Hopkins since 1906.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 3, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,037,200. HOLDING SLEEVE FOR CONDUITS; F. M. Brinckerhoff, New York, N. Y. App. filed Feb. 17, 1911. Lock nut and box joint.

1,037,268. PROCESS OF MANUFACTURING INCANDESCENT BODIES; H. Kuzel, Baden, Austria-Hungary. App. filed April 10, 1906. Uses colloidal oxides and hydroxides of refractory metals.

1,037,290. VACUUM-TUBE LIGHTING; D. McF. Moore, Newark, N. J. App. filed April 7, 1906. The system employs a number of vacuum tubes connected to a conduit system and a single transformer.

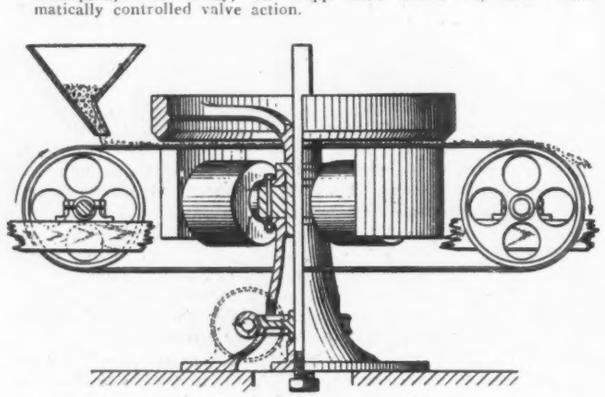
1,037,304. SOCKET SWITCH; W. G. Peet, Bridgeport, Conn. App. filed June 25, 1912. Pull switch with oscillating blade.

1,037,330. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed May 4, 1909. Step-by-step selector with distributing resistance in the relay circuit.

1,037,344. CONTROLLING DEVICE FOR ELECTRIC MOTORS; J. J. Sinclair, Upper Montclair, N. J. App. filed Dec. 7, 1911. Electromagnetically controlled ratchet.

1,037,349. ELECTRIC PIANO; I. B. Smith, Philadelphia, Pa. App. filed Feb. 19, 1906. Electromagnetic hammer.

1,037,369. ELECTRICALLY HEATED STEAM RADIATOR; J. S. Thompson, Mill Valley, Cal. App. filed March 12, 1912. Automatically controlled valve action.



1,037,563.—Magnetic Separator.

1,027,370. PROCESS OF DRYING AND BLEACHING; J. D. Tompkins, Valatie, N. Y. App. filed Dec. 20, 1910. Electric current is passed through a traveling wet web of paper.

1,037,379. VACUUM APPARATUS; E. Weintraub, Lynn, Mass. App. filed Dec. 13, 1910. Mercury seal for a silica container.

1,037,397. INCLOSED FUSE; G. Wright, Schenectady, N. Y. App. filed Aug. 26, 1909. Plurality of parallel trough-shaped strips.

1,037,421. PROTECTING DEVICE FOR ELECTRIC-RAILWAY PLOWS; W. L. Boyer, Kingston, N. Y. App. filed May 1, 1912. Underground conduit contact shoe.

1,037,433. MOTOR-CONTROL SYSTEM; E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 19, 1912. Series parallel system with a relay and master controller.

1,037,435. MOTOR-CONTROL SYSTEM; F. E. Case, Schenectady, N. Y. App. filed Dec. 4, 1911. Series parallel control in connection with storage battery.

1,037,438. TELEPHONE-EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed March 20, 1908. Semi-automatic party line; subscribers' call.

1,037,447. ELECTRICAL APPARATUS; T. F. Crocker, Dayton, Ohio. App. filed Sept. 18, 1911. Semi-automatic telephone for Keith system, etc.

1,037,452. ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS; A. T. Dawson and G. T. Buckham, Westminster, London, England. App. filed May 4, 1912. Motor-driven switches, with number drums for artillery-fire control system.

1,037,470. MAIL-BOX ALARM; M. W. Grindle, Santa Rosa, Cal. App. filed Feb. 13, 1911. Alarm given when mail is deposited.

1,037,485. ELECTRICAL APPLIANCE FOR GAS ENGINES; J. W. Jepson, New York, N. Y. App. filed March 29, 1910. Automatically regulated dynamo-electric ignition.

1,037,500. OZONIZER; R. M. Leggett, Ann Arbor, Mich. App. filed Nov. 23, 1911. Compressed-air cooling.

1,037,522. ELECTRIC CABLE; V. P. von Pindtershoffen, Wiener-Neustadt, Austria-Hungary. App. filed Jan. 27, 1909. Air insulation.

1,037,525. ROTARY CONTACT FOR SNAP SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed April 24, 1912. Double-crossed arms.

1,037,536. TREATMENT OF MOLTEN STEEL; J. W. Richards, South Bethlehem, Pa. App. filed Dec. 8, 1910. The finished molten steel is transferred to an acid-lined induction furnace and kept melted until ready to cast.

1,037,537. RINGER FOR TELEPHONES, &c.; H. J. Roberts, Evanston, Ill. App. filed May 1, 1905. Polarized type.

1,037,558. ALTERNATING-CURRENT RECTIFIER; C. P. Steinmetz, Schenectady, N. Y. App. filed May 23, 1905. Mercury arc.

1,037,563. MAGNETIC SEPARATOR; G. Ullrich, Broken Hill, New South Wales, Australia. App. filed Dec. 13, 1906. A conveyor moves between a magnetic member and a pole piece.

1,037,566. ELECTRIC SIGNAL LAMP; W. J. Warder, Jr., Chicago, Ill. App. filed Nov. 6, 1911. Plurality of bulbs with automatic focusing.

1,037,573. ELECTRIC HEATER; C. H. Allen, Chicago, Ill. App. filed May 26, 1911. Ironing roller.

1,037,580. CIRCUIT-CONTROLLING MECHANISM; F. Bechoff, Schenectady, N. Y. App. filed Dec. 16, 1908. Remote control of interlocking devices such as oil switches.

1,037,585. ELECTROLYSIS OF LIQUIDS; J. Billiter, Vienna, Austria-Hungary. App. filed July 8, 1910. Horizontal cathode strips with covering gas conduits.

1,037,603. ELECTRICAL MUSICAL INSTRUMENT; H. R. Dicks, Grey Eagle, Minn. App. filed Jan. 20, 1912. Key-operated bell ringer.

1,037,606. ELECTRICAL CONTACT FOR RAILWAY CROSSING BELLS; E. D. Every, Mason, Mich. App. filed Nov. 13, 1911. Attached to the rail.

1,037,636. TELEPHONE SYSTEM; J. Kennedy, St. Louis, Mo. App. filed July 20, 1908. Interconnecting cord circuits with lamp signals.

1,037,673. AUTOMATIC TRAIN-CONTROLLING SYSTEM; F. D. Shindel, Huntingdon, Pa. App. filed Feb. 16, 1911. Train stop for single-track roads, etc.

1,037,683. CURRENT-REGULATING DEVICE OR RESISTANCE APPLICABLE FOR ELECTRIC LIGHTING OR HEATING; W. Sumner, Liverpool, England. App. filed Jan. 5, 1912. Fibrous material impregnated with carbon.

1,037,713. METHOD OF MAKING SILICON ARTICLES; T. B. Allen, Niagara Falls, N. Y. App. filed June 26, 1911. Magnesium is added to molten silicon.

1,037,744. APPARATUS FOR A PROCESS OF FUMIGATION; F. M. Duncan and W. S. Eisenberg, Los Angeles and Alhambra, Cal. App. filed June 25, 1910. Produces hydrocyanic acid gas.

1,037,767. ALARM; S. Hoge, Waynesbury, Pa. App. filed June 20, 1911. For incubators, drip-pans, boilers, etc.

1,037,771. FOOD CARRIER; J. Hughes, San Francisco, Cal. App. filed April 19, 1912. Electrically heated receptacle on wheels.

1,037,825. TROLLEY-WHEEL RETAINER; S. A. Findura, McKeesport, Pa. App. filed March 4, 1912. Spring-pressed pole with guards.